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GENERAL CULTIVATION.

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GENERAL CULTIVATION.

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1923.

Nipah Palm (Nipah Fruticans)

General Cultivation.

Soil Cultivation. Agriculture in this country has advanced enormously during the past few years and is now being developed on more scientific lines. The rubber industry in the Peninsula has grown in the last twenty years from a relatively small acreage to a total of approximately one and a quarter million acres. One would naturally expect that methods of soil treatment would have been improved and kept pace with this rapid increase.

THERE is little tillage conducted on rubber estates and, in many instances, the lie of the land will not permit of this as the steep slopes are liable to surface erosion. As far as rubber is concerned it is questionable whether deep tillage will repay the cost of the operation, but if it is recommended, then it should be done in conjunction with green manuring.

ON badly drained, flat land, where the root system is superficial, deep tillage is disastrous as the roots are severely damaged. Shallow tillage towards the end of the wet season is beneficial as it assists in retaining soil moisture over the dry period.

THE coconut palm responds well to tillage and several coconut estates are now using motor tractors. This palm is grown almost entirely on the plains and to a small extent on undulating land where tractors can be used.

IN fruit orchards the turning over of the soil, once a year, is necessary to obtain good yields; but, unfortunately, this is not done except by a few progressive growers.

ANNUAL crops are very much neglected as regards cultivation; it is not possible to obtain good results unless the soil is brought to a fine tilth and maintained in a high state of fertility.

CHINESE vegetable gardeners are fully aware of this; but, when annual crops are grown on a field scale, sufficient cultivation is not, as a rule, given. The small holder devotes little or no care to soil treatment except in the case of rice and vegetables.

THE method of cultivation generally adhered to, on the larger estates, is clean weeding; the reason for advocating this system is the necessity of detecting the presence of "lalang" (*Imperata arundinacea*), a noxious weed which is more easily detected if the land is clean weeded. Lalang is a disastrous weed to any crop, and it is essential that proper supervision be given in order that it may not become established.

EUROPEAN estates are practically free from lalang, but—unfortunately—the same cannot be said of small holdings. Clean weeding on flat and on gently undulating land is perfectly sound, but on no account should it be carried out on hill land which is subject to soil erosion.

Soil Conservation. The hills and undulating land of the Peninsula are subject to considerable surface wash when the land has been cleared of jungle, shrub, or grass, and the importance of preventing this is now fully recognised.

Germinating Seed Coconuts.

The surface layer is rich in humus and available plant food; consequently, denudation is responsible for a reduction in fertility and of deterioration of the texture of the soil. It is doubtful whether green manuring and the application of artificial manures will ever compensate for this loss of surface soil by wash; and, in any case, the expenditure involved in attempting to restore this fertility is heavy. There are several methods of conserving surface soil, the most common and effective being the growing of a cover crop. Other methods are strip weeding, circle weeding, catch pits, terracing, bunding, and the planting of strong growing grass in contour. On undulating land a leguminous cover is recommended. In the case of very steep slopes, catch pits are not very effective and it is frequently impossible to establish cover crops. The most satisfactory method is strip weeding in contour, or circle weeding around the trees. Terracing is an ideal system but it is difficult to construct a terrace in contour in planted areas without doing considerable damage to a number of the trees.

It is frequently found that the surface of a soil is so hard that the rain water flows over it and only a small amount of moisture is absorbed. Catch pits are useful in such cases, as a considerable proportion of the water is retained by the pits and gradually passes through the soil.

Drainage. On the plains, the water table is, as a general rule, near the surface; but there is considerable variation in different soils and in various districts. Soils with a high water table require to be thoroughly well drained before any attempt is made at planting. In the case of the rubber tree it is essential to have the land well

drained in order that a good tap root may be formed. In water logged land the roots of the rubber tree are superficial and it frequently happens that, during wind storms, many of the trees are uprooted, especially if "thinning out" has been done. In badly drained areas the trees are poor yielders of latex, are not well grown, and are liable to become diseased. Most other crops require equally good drainage.

LAND subject to tidal influence is not recommended unless the water can be kept off the land by flood gates. Flat land, well drained, has a more constant and regulated supply of moisture than is found on undulating or hilly land; this is of importance as it assists a crop to withstand a dry spell. The conditions of flat coast land are generally such as necessitate adequate drainage to permit of good returns being obtained.

Cover Crops. Cover crops are frequently associated with green manures; and, although the former will also perform the objects of the latter, green manuring is done principally for incorporating organic matter in the soil so as to improve its physical condition. One of the most important factors which commends the growing of covers, at least on hilly and undulating ground, is the prevention of surface wash. A suitable permanent cover should provide heavy shade on the surface in order to retard the growth of weeds. The cost of weeding is high when lalang appears in cover crop areas; for this reason, a most careful selection of the plant should be made in order that it will thrive on the land and thus provide the maximum shade with the minimum risk of lalang becoming established. In young clearings no

difficulty is experienced in growing a cover, provided the top soil is even moderately rich; but in badly washed areas it is a different proposition and it is necessary to prepare the spot thoroughly for the reception of the seed. This may be done by constructing a low furrow, in contour, and applying a handful of well rotted cow manure at the positions where the seeds are to be sown in the furrow.

THE first four years in the history of a rubber or coconut estate is the most suitable time for improving the land by means of incorporating green manure in the soil, and it is unfortunate that more advantage is not taken of this period to improve the mechanical condition of the soil.

GIVEN good land, there is probably no cover more satisfactory than *Centrosema Plumieri*. One of its special advantages is that the labourers can pass over the cover without the slightest difficulty or inconvenience; it can be recommended also as a green manure. When it is established, in a young clearing, it will continue to thrive under comparatively dense shade. Owing to the low cover which it provides on the land it is a successful means of preventing soil wash, but it should be clearly understood that it is most difficult to get it to grow on eroded surfaces; for this reason, it should be planted before such damage has been done, as unquestionably a good top soil is essential for its proper growth.

Vigna oligosperma is now finding much favour as a cover plant; it has much to recommend it, but unfortunately it thrives well only on certain classes of soil.

Review of Crops. The three chief agricultural crops in the Peninsula are rubber, coconuts, and rice.

Coffee, once a crop of some importance, now occupies comparatively a small area as a secondary crop to rubber. Coffee requires to be grown on the richest soils of the country before it is likely to prove a financial success; it is not recommended to grow it as a sole crop, but inter-planted with some other form of cultivation.

The best and steadiest crops of Liberian coffee have been grown on land of a peaty nature and low country. Robusta coffee thrives best on a loose clay-loam soil.

Sugar was at one time cultivated in the Peninsula, principally in Province Wellesley and Lower Perak, but it is now only grown by the small holder for the local market. A number of improved varieties of sugar are under trial by the Department of Agriculture. It is unlikely, however, that sugar will receive much attention as a planting proposition for the present, owing to shortage of labour.

A great deal of interest is now being taken in the production of vegetable oils and new sources of supply. The African Oil Palm (*Elaeis Guineensis*) has attracted much attention lately and there is every reason to believe that the oil palm will thrive in most soils in this country which are capable of holding a fair proportion of moisture, but rich moist soil would probably give the best return. It would be expected that this crop would generally be suited to soils of the coconut type and this is probably correct, but remarkably fine specimens have been grown on gently undulating land. There are large areas in the Peninsula suitable for the cultivation of the oil palm and, judging by the number of applications received by the Department of Agriculture for information on the subject, it is likely that

Terracing.

this industry will develope. One estate in Selangor has obtained exceedingly good results, both as regards yield and quality. The Department of Agriculture is in a position to supply seed in fairly large quantities and is in touch with other sources of supply.

THE industry is an attractive one from several stand points. There is a very wide market for the oil which is required in vast quantity, and the price in normal times is fairly steady. In Malaya, it would be possible to work a property on up-to-date lines, but how this will compare with the native industry in Africa is difficult to say.

IN addition to coconuts and the African Oil Palm there are other oils which may be grown with success. There is an import of ground nut oil into the Peninsula equal in value to approximately $2,000,000 a year. Several estates have taken up the cultivation of groundnuts, and special mention might be made of one property in Perak where satisfactory profits have been made. There is a ready sale for the oil and, provided the crop is grown under suitable soil conditions, its cultivation can be recommended. Gingelly is another oil with possibilities.

THE cultivation of Tea has, from time to time, been the subject of some interest but it has never been planted except on a small scale. There is little doubt that tea may be grown with success in Malaya; and, provided suitable labour is available and a market can be found for the produce, it should prove a sound undertaking.

THE Malay Peninsula was at one time the principal spice growing country in the East Indies and large quantities of pepper, cloves, and nutmegs were

exported annually. This industry has dwindled down until it is now of little importance. The spices that are produced command good prices. The experimental cultivation of these crops on a commercial scale is being undertaken by the Department of Agriculture.

TAPIOCA, which was formerly grown on a considerable scale, is still cultivated, though to a less extent, in Negri Sembilan, Pahang, and Johore.

THE cultivation of fibres has created a considerable amount of interest recently, many enquiries having been received by the Department of Agriculture regarding them. Those of chief interest are Roselle, Manila, Sisal, and Mauritius. Roselle Fibre is being grown on one or two estates on a commercial scale, and seed has been distributed by the Department of Agriculture to nearly a hundred applicants. There is a good local demand for the ropes which are made from Roselle and a certain amount of the fibre is being exported. Roselle is a four months' crop and it is recommended to grow it in rotation with groundnuts. It thrives in a variety of soils and seems well suited to Malayan conditions. Arghan Fibre has created much interest, but there is comparatively little information on the subject.

Kapok (Kabu-Kabu). This is grown by Malays generally throughout the country, but in very small quantities. If the facts concerning the market were better known, and collection organised, the cultivation of this crop might be extended.

THE Department is giving serious consideration to these aspects of the problem. One or two capitalists are interested in the growing of Kapok on a commercial scale.

Tobacco. The Department of Agriculture has carried out experiments on tobacco cultivation, and the conclusion has been reached that the production of this crop is possible on average good soil.

The class of tobacco recommended is that suitable for the manufacture of cigars which are popular among the Asiatics; it will be wiser to fill this demand rather than to encourage the cultivation and curing of tobacco for the European market.

Samples of tobacco leaf grown at the Government Plantation, Kuala Kangsar, Perak, were favourably reported on by local manufacturers.

There is a considerable quantity of tobacco leaf imported from Sumatra and Burma and manufactured into cigars locally. It must be remembered that locally grown tobacco is protected by Government, as it is not liable to the import duty on tobacco.

Tuba Root (Derris Elliptica). A good deal of interest is being taken in the cultivation of Tuba Root. Chinese gardeners appreciate its value, but grow it on a small scale only, mainly for the purpose of providing an insecticide for use in their vegetable gardens. The cultivation of this crop, however, is being considered by the larger planter and one or two estates are now growing Tuba on a fairly large scale. The Ministry of Agriculture and Fisheries, London, report that there is, as yet, no trustworthy information concerning the relative toxic contents of the different species of *Derris* or of the varieties of the species *Derris Elliptica*, since botanic specimens have not been

obtainable. Every endeavour is to be made by the Department of Agriculture to obtain suitable botanical specimens for purposes of identification. The Ministry further state that it is at present too early to answer definitely as to the probable demand for the product; but there is no doubt that *Derris* has valuable insecticidal properties and that it will take its place among the older insecticides, if it is handled in a sound manner from the commercial point of view.

Native Agriculture. Agriculture, other than the cultivation of rubber, coconuts and padi, as carried on in this country, consists of "mixed farming." It is almost entirely in the hands of the Chinese and Malays. Near all large centres of population are found Chinese market gardeners who supply the local markets with vegetables, and in some cases send their produce to the larger towns in the Peninsula. Such cultivation is conducted under Chinese methods, which carry with them obvious objections. The Chinese have also been the pioneers in numerous other crops; of which tapioca, pineapples and, formerly, gambier and pepper are the more important. Tapioca is less cultivated than was the case a few years back, owing to the fact that the land has been "worked out" and, in most cases, has since been planted with rubber. Pineapple canning—a Chinese industry in Singapore—has diminished, for the canners find difficulty in obtaining sufficient pineapples to keep their factories working. Cultivators, on the other hand, are less inclined to plant pineapples, as they impoverish the soil. There has, however, been a revival recently in this cultivation.

Centrosema Plumieri, as a Cover-Crop under Young Rubber.

The efforts of the Chinese to establish fruit industries is worthy of note. There are now a few good fruit orchards, owned by Chinese, principally in Malacca and Penang, from which markets are regularly supplied.

The Malays lack the organizing power of the Chinese, and also their industry. The competition for life has never been keen with them, as with the Chinese in China, and this is reflected in their agricultural systems. Generally speaking, one may state that Malay agriculture lacks effort, and their systems are devised without respect to the amount of labour involved. This is surprising in an easy-going race, but the reason probably is that their wants have been so simple that the work involved in supplying necessities is comparatively small. It must be remembered that, until recent years, the Malay obtained the majority of his necessities from the jungle, and that his mentality has, as yet, hardly grasped the new order of life. As time goes on, Malay life recedes from the jungle, and with the diminishing knowledge of jungle produce which follows, he has to rely more on cultivated plants.

The gradual transition from this old order to the new was rudely interrupted by the introduction of rubber into Malaya. In this crop the Malay saw that he might earn sufficient to supply his wants without much effort. The consequence has been that agricultural enterprise amongst Malays has been practically killed—he has lost his old cunning without acquiring new experiences in agriculture.

New systems have to be introduced to change this order of things. Comparatively little can be done with old Malays of set habits of life, but much is

possible with the younger generation. It is for this reason that the Department of Agriculture has advocated a system of agricultural education (really rural economy) for Vernacular schools.

To deal with present day "Native Agriculture" as it applies in particular to Malays, nothing can be done without encouragement; one can call to mind many industries that are suitable for Malay adoption, but only so far as they are encouraged in the correct way. For the introduction of an agricultural industry amongst natives there are two essential conditions—firstly, instruction in cultivation and marketing; and secondly, financial aid. The matter of instruction is in the hands of the Department of Agriculture, and that of organization of small industries must be dealt with by the recently created Government Co-operative Department. In the publications of these two bodies will be found the suggestions for the improvement of native agriculture.

The following agricultural industries suitable for Malays and other Asiatic owners of small holdings may be mentioned.

Padi. This cultivation, under existing conditions, is more suitable for small holders than for planters on a large scale. The main difficulties have been water control and cost of labour. Padi yields, outside the Krian area, are generally poor, and until the Malay is supplied with better types of seed, and can be more sure of a regular water supply, there is not likely to be any increase of area planted under this crop.

Fruits. Apart from a few imported fruits, and the supplies obtained from Chinese-owned orchards, the local market supplies of fruit

are obtained from Malay "Kampongs." There is obvious scope for larger areas than those which exist, for the local demand exceeds the supply. With the introduction of larger areas must come better cultivation, if small orchards are to be carried on at a profit. The quality of most of the Malayan fruits is poor, and it is notorious that many of these fruits are but jungle trees. The Government have in hand schemes for the supply of good fruit stock to Malays; but, owing to slow maturity of fruit trees, the progress of such work must be gradual.

AMONG the multitude of minor crops grown by natives, on which advancement is possible, might be mentioned tuba (used as an insecticide), coconuts, coffee, chillies, areca nuts, spices, tobacco, roselle fibre and kapok. No account, however brief, of potential native agricultural industries would be complete without mention of live stock.

THE Malay homestead has been made familiar to us by its straying hens, but the production of hens and eggs as an industry is practically untouched. The Malay and, to some extent, the Chinese fowl is neglected. It is underfed, badly housed, and poor in quality. Consequently disease amongst poultry is rife and the native obtains but a poor return from this source. The few poultry farms that exist have proved that the rearing of good poultry in this country is possible and profitable. There is, therefore, an opening for the raising of poultry in this country under careful control.

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Rubber Estate, shewing Tapping by Single Cut on a Quarter.

Rubber.

THE programme of the British Cotton Industry Research Association lays down as two possible lines of advance:—

(1) To attack problems directly by methods based on past experience without seeking to investigate the fundamental nature of the process.

(2) To try to understand the chemical and physical changes produced during manufacture and so to establish gradually a broad roadway along which future advances may be made.

IF for "manufacture" be substituted "growth" an excellent definition of the aim of the best form of scientific research for the improvement of any crop is obtained. Unfortunately this fundamental method is almost painfully slow and laborious, and the first method is bound to be employed at the birth and during the youth of any industry.

Research and Rubber Growing. As it happens, the Para rubber tree is a plant concerning which it is decidedly dangerous to argue from analogy, and even now nothing is known of the processes involved in the formation of latex. Realising therefore that the present plantation practice is the result of dearly-bought experience in the laboratory and in the field, the methods by which modern scientific research may be expected

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to assist plantation companies to pay the largest dividends over the longest possible period are, in one form or another, the object of all agricultural work. Apart from economic factors, such as effect of increased production on selling price, the principal methods must be those for the improvement of yield per unit area (due regard being paid to the cost of collection), at the same time preserving the trees in a perfect state of health over as long a period as possible.

In the case of new areas, considerable expectations have been aroused by the benefits which it is hoped to derive from the planting of selected stock. From some points of view attention would appear to have been unduly concentrated on what is after all an experiment, affecting the relatively small area likely to be planted in the immediate future. It is necessary to point out that expectations of this nature are based on *a priori* arguments and not on actual results, and it remains to be proved that the variability admittedly existing in rubber is fixed, and that high yield can be transmitted from parent to offspring.

It is not suggested that selected stock should not be planted, but that planters should realise that their hopes may not be fulfilled. It would certainly be inexpedient at the present time to plant widely (say 50 trees per acre) in the hope that all the trees, because selected, will be highly yielders.

The real need for research of the second type has been recognised by the F.M.S. Government since 1904 when the Department of Agriculture was formed. Steady increases, both of material and personnel, have taken place since that date.

LEAVING aside strictly agricultural methods, it is permissible to doubt whether perfection has been attained in agricultural economics and organisation on the majority of estates; whether, for example, attention to the harvesting powers of workers would not be quite as important as attention to the yielding powers of trees. A similar point is the economic size of plantations; it would seem at least possible that more economical working might be attained by amalgamations of smaller properties.

THE working out of these latter problems, however, would appear to be outside the scope of an Agricultural Department.

Selection of Hevea. Although much has been said and written on this subject, in the absence of experimental proof of the success of the methods which have been suggested and adopted from time to time, it still presents a vague aspect. Thus, the problem of Selection of Hevea is still new and relatively unexplored territory and sorely needs the application of all our knowledge of genetics and horticulture in order to produce high yielding races of rubber trees. "Hevea" is probably the most recent plant brought under cultivation and as such has not yet been affected by the selection which man applies, consciously or unconsciously, to all useful plants. The general method of thinning out, by selection based on yield, will slowly but surely tend to improve the yielding capacity of our trees; though, being perennial plants, capable of living to a fair age, no appreciable effect is likely to be detected within two or even three generations of man. It is still open to doubt whether seeds of the best types of Hevea were imported into the East in the first place, but it cannot be disputed

that the scope for selection amongst the trees on our plantations is very wide. This latter fact is amply disclosed by a study of the accumulated mass of data regarding the variation of our populations of trees. Whatever method of plant improvement is applied to Hevea, it involves in the first place a choice of parent trees, which necessitates a systematic study of the variation between individual trees on a plantation. During the past seven years a considerable amount of investigation has been carried out in this connection in all Eastern rubber producing countries.

WHITBY, Cramer, and several others have published interesting and conclusive articles proving variation in Hevea in almost all its parts; leaves, seeds, bark, branches, root systems, and in quality and quantity of rubber etc.; but we are concerned chiefly with dry rubber production.

IT remains to be proved by experiment that the variation is due to inherent differences, and not to accidental differences of environment, both present and past.

THE Botanical Division of the Department of Agriculture has figures extending over two years, which show that the variation in latex production per alternate-daily tapping, from a population of approximately 500 twenty-eight year old trees, ranges from practically nothing up to 15 ounces or from 0 to 45 lbs. of dry rubber per tree per annum. Moreover, of this population, not less than 11 trees yield over 28 lbs. dry rubber per annum, with alternate day tapping on a V on half the tree, and in every case the cut was situated, during the entire tapping period, more than one foot above the base

of the tree. The magnitude of the variation in dry rubber production is thus very apparent, and it is clear that if pure races of these heavy yielding trees can be produced, then acreage productions on our estates will be vastly increased. The crux of the situation lies in the problem of isolating and propagating pure races of these heavy yielding trees. This problem must be considered as distinct from that of the breeding of trees resistant to diseases or possessing other distinct characteristics.

Two courses are available to the experimentalist:—

Seed selection.
Vegetative propagation.

Seed selection.

(i) Mass selection.
(ii) Pedigree selection.

It has been found that large heavy seeds of Hevea germinate more rapidly and produce stronger seedlings than those derived from small and light seed, because they carry more food for the young plants and give them a better start in life. Therefore a rough grading of seed into light and heavy groups, with consequent use of the latter only, will produce healthier nurseries than can be obtained from unsorted seed, and thus ensure healthy stock for planting. This method is very superficial and does not take into account the inherent quality of each seed; nevertheless, in mixed populations, it is likely to have a good effect and is one of the few practices which every planter can adopt. Present methods of thinning out trees by selection based on the health and yields of individual trees is really a form of mass selection, though its effects can only be seen in the progeny derived from seed obtained from

estates thinned in this manner, and the results depend on the intensity and thoroughness of the selective thinning. It would be advisable for each large estate to mark its best area for seed production and to adopt a very strict programme of thinning on an area say of one hundred acres for this purpose. In a block of this nature the intensity of the selection of parent trees could be increased from without inwards in such a way that the middle twenty acres would contain only sound, well developed trees of pronounced yielding ability. The seed for the nurseries for supplying new clearings could then be taken from the innermost five acre block. Such seed, resulting from cross pollination between high yielding trees, can reasonably be expected to produce trees of better yielding capacity than the average progeny derived from seed which has not been selected in any way.

At the same time, it must be understood that the progeny from seed selected in this manner is likely to contain a proportion of poor yielding trees because the constitution of the parent trees is unknown; but on well-managed estates this proportion would soon be reduced considerably by ordinary selective thinning operations. Thus, though plantations of better yielders than the average are likely to result from this method of seed selection, the method can never give rise to a uniform highly productive plantation, because it is based on the chance combinations of hereditary characters in previous generations of cross-fertilised trees; it is a useful method, however, that can easily be put into practice.

Pedigree seed selection is by far the best means of improving our plantations permanently, but can only be attempted by trained Botanists, preferably

in Government employ in order to ensure the continuity of work which must spread over more than a dozen years. In order to obtain a high yielding, healthy strain of Hevea it is necessary to isolate a single strain, possessing the required characters, which will breed true to type. Through cross fertilisation in several generations, the present plantation rubber tree is of very complex nature and to isolate such a strain requires a large amount of systematic work, especially since at least three characteristics are involved, namely yield, quality, and disease resistance. Work of this nature has been initiated in Java, though little is known as to its progress to date.

Vegetative Propagation. Methods of propagating vegetatively good yielding parent trees may be divided into two groups; those providing for their own root system, and those in which one tree is grafted on to another. It is probable that the root system is as important to latex production as are the parts above ground. Methods of developing root systems include marcotting and cuttings. The former has been carried out successfully in Java but it is laborious and difficult, and requires horticultural experience.

CUTTINGS carry with them the characteristic root system of the parent tree as far as is known, and if the roots develop well this method of propagation is to be preferred to all others. Unfortunately, this method of propagating selected parents has not, so far, been sufficiently successful to warrant its adoption on estates, but experiments are still in operation. Methods whereby a high yielding, disease-resistant tree is grafted upon another root system are numerous. One of the simplest is budding, which

has already been carried out successfully on many plantations, although the question, whether the yielding ability of the parent tree from which the bud is taken will be unaltered by the new root system of the stock on to which it is grafted, is still problematical and awaits proof.

ALL methods of selection involve careful choice of parent trees and these can only be chosen after definite data and recorded observations have been taken over not less than a complete annual cycle, though an extension to several cycles would give proportionally more reliable figures. The chief factors which should be considered in selecting parent trees are (i) age, (ii) disease resistance, (iii) yield, (iv) robust growth, (v) good bark development, (vi) quality of latex, (vii) situation, (viii) history; though much has been done already in the way of selecting parents, there is still a wide field for research in connection with the study of methods of propagating them and of maintaining pure races of good yielding trees.

Budding of Hevea. The operation of budding Hevea is comparatively simple provided certain precautions are taken. As far as the actual practice of budding is concerned the work is now on an established basis and employed on a number of estates that are planting rubber. As to whether these areas, when in tapping, will give the yields that are anticipated remains uncertain.

THE trees that have been selected as the heaviest yielders on any particular plantation will provide the material for future planting. It is necessary to raise nurseries of robust seedlings as stocks for budding from the selected trees. The seedlings are

ready for budding when from six to twelve months old; older stumps that have already been planted out in the field are not recommended as stocks. Budding should not be performed during the wintering period or during wet weather.

A sharp knife and a supply of waxed binding cloth are required. Ordinary unbleached cotton cloth is suitable and is readily procurable. For waxing, the following ingredients are recommended:—

> 50 per cent. Petroleum Jelly (Paraffinum Molle Flav).
>
> 50 per cent. White Paraffin Wax (melting point $120^{\circ}/130^{\circ}$ F.).

THESE substances are melted together in a kerosine tin over a fire and, after thorough mixing, the mixture is ready for waxing the cloth and is removed from the fire. A convenient size for the cloth is 16 inches wide by 10 yards long. The cloth is immersed in the warm liquid wax and subsequently hung over a frame in a cool shed to dry. After cutting into strips 16 inches long by 1 inch broad, the cloth is ready for use.

MATURE bark only should be used as "bud-wood" and it must peel readily from the branches of the mother tree. The branches should be removed from the trees early in the morning and be cut into short lengths; they are then stored in kerosine tins and covered with damp sacking to prevent evaporation. A rectangular tongue of bark, 2-3 inches long by one third the circumference of the stem, is lifted at the base of the stump, and a bud, attached to a piece of bark of approximately the same size, from the selected tree, is inserted beneath. Buds

Centrosema Plumieri, as a Cover-Crop under Young Rubber.

are readily distinguishable upon close examination and are situated immediately above a leaf-scar. It is not necessary for the bud-patch to fit the excised area on the stock exactly, as this space serves as an outlet for the latex which exudes from the patch. On cutting the bud-patch from the branch, a portion of wood is frequently removed also; this must be taken out with the point of the knife. The bud-patch after insertion is covered by the tongue of bark on the stock and then bound up with a strip of the waxed cloth which, when rubbed over gently with the hands, becomes softened and adheres to the stem. To prevent the latex from the stock from forming a film over the exposed cambium and thus preventing the proper union of the stock and the bud-patch, it is necessary to outline a number of the incisions a short time before the bud is actually removed and inserted beneath the tongue of bark of the stock.

AFTER two weeks from the time of budding, the binding is removed; the tongue of bark is cut away and the bud-patch examined. Failures may have another bud inserted on the opposite side of the stock and be treated as before.

THE successful stocks are left for a week, when they are cut back to within a foot of the living bud. Any lateral shoots that appear must be removed. The majority of the buds will sprout within a month, but 25 per cent. may take as long as six months to grow. The stocks are ready for removal to the field when the sprouting bud is from one to three inches long. After the young trees are firmly established the upper portion of the stock should be sawn off to within one inch of the growing bud. A skilled coolie

should be able to bud about 200 stocks a day, with a proportion of success varying from 75 per cent. to 90 per cent.

It is possible by marcottage of the young tree when one year old to propagate it actually on its own roots; the stock serving as a temporary feeder only.

Further information on the vegetative propagation of selected stock of Hevea is contained in the Agricultural Bulletin, F.M.S., Vol. IX, Nos. 2 and 3.

There have now been published a limited number of results of tapping bud-grafts in Java and Sumatra (where the operation was first carried out). These results do not show any marked superiority of budded material over seedlings of similar age, and one Dutch worker has recently stated in a lecture that bud-grafting may be of use only as a means of multiplying material for selection purposes, and not for planting up estates in the ordinary way.

This conclusion is possibly as unduly pessimistic on the one side as the confident expectations of enormous yields were over optimistic on the other. The only safe view of the process at the present stage would appear to be that taken from the first by the Officers of the Department of Agriculture, that bud-grafting is an experiment, a necessary, perhaps a vital, experiment but——an experiment.

The Slump. The effect of the world-wide depression made itself first felt in the rubber market in October, 1920, with a fall of price to 52 cents per lb. in Singapore. This fall continued steadily till June, 1921, when the price was 25 cents per lb., after which there was a slight rise to 37 cents

at the close of the year, while the situation was not bettered for the last 9 months of 1922. The cause of the trouble was obvious—over-production relative to the purchasing power of an improverished world; but the equally obvious remedy, restriction of output, proved impossible of attainment by private action. There were many reasons for this, but the primary one was lack of reserve funds which necessitated the highest possible production to cut overhead charges to the lowest point per lb., and to enable Companies to maintain a hand-to-mouth existence.

At first little was done, those interested trusting either that the market would soon recover, and consumption overtake production, or that "survival of the fittest" would operate and the financially or agriculturally weaker properties go out, leaving larger profits for the survivors in the future. It was however soon realised that the same hardiness which makes para rubber so safe an investment *agriculturally in Malaya*, precluded the success of such a policy. Once established, it is almost impossible to kill or seriously injure rubber by neglect, and abandoned rubber can be cleared and brought back into tapping as soon as the price rises to remunerative levels. When it was fully realised that the slump was bound to be prolonged, a strong demand arose for restriction of output and many schemes of voluntary restriction were put forward. None however won sufficient adherents to produce the desired effects, and in November, 1922, a Government scheme of restriction was introduced in Malaya and Ceylon. This scheme permits the export of a fixed proportion of "standard production," varying with the price ruling for the previous

quarter, starting with 60 per cent. of standard when the London price is 1/3*d*. or under. Any rubber above the permitted amount from the F.M.S. exported is subject to a heavy tax. The immediate result of restriction was to raise the price of rubber from –/9 to 1/4 per lb.

Modern Agricultural Practice on Rubber Plantations. The remarkable adaptability of Hevea to widely varying conditions of soil and situation in Malaya and other Eastern tropical countries has, in the past, led to neglect of many agricultural operations, such as tillage, manuring and soil conservation, which are matters of routine in most other cultivations. In many cases this neglect has been justified by results, in others damage has resulted.

THE only work which was early realised to be essential was the drainage of low-lying, flooded coastal lands, but with increasing certainty of the permanence of plantations more attention is being directed to soil problems.

IT is proposed to consider briefly various methods of treatment of the soil, which are considered necessary in certain circumstances; and also problems which require consideration in regard to the plant itself.

Tillage. Any extensive and deep cultivation of the soil is impracticable after the trees are more than about 18 months old, and is in practice only carried out as an operation incidental to the removal of "lallang" when planting up such land. Shallow cultivation suffices for the propagation of jungle soil. In a few cases deep changkolling

(hoeing) or disc ploughing is resorted to and beneficial results have been claimed, but no controlled experiments are reported in Malaya, while recent work in Sumatra extending over three years shows no positive results following cultivation in the case of rubber of seven years of age. It seems unlikely that cultivation of soil will ever become general, or that its adoption will be justified.

Weeding. Clean weeding has long been generally adopted; in addition to freeing the trees from competition, supervision and movement are rendered easier and the light, incidental cultivation is of value by breaking up the hard surface cake or glaze which is readily formed on some soils, and through which rain penetrates with difficulty.

ON flat land there is much in favour of clean weeding, but on hilly land it is thoroughly bad and has resulted in considerable damage by soil wash. Realisation of this fact, together with the present need for economy, has directed increased attention to the use of cover crops.

Cover Crops. The advantages of cover crops are: reduction of working costs, by obviating weeding; and conservation of the soil. The disadvantages are the difficulties of eradication, supervision, movement, and in some cases of early identification of root diseases. *Centrosema Plumieri* is at present the most popular and useful cover for soil in good condition, but cannot be established on poor or badly washed soils. Giant Mimosa (*Mimosa Invisa*) will grow on comparatively poor and badly washed soils. It is necessary to confine this cover to strips between the rows of trees on account of the formidable spines on its stem. On undulating

and hilly land, the cultivation of suitable cover crops, particularly leguminous plants, such as *Centrosema Plumieri*, is undoubtedly preferable to grass and weeds for the conservation of the soil, and is more easily eradicated if necessary.

Green Manuring. Green manuring, i.e. the cultivation and digging in of green cover crops, is generally unnecessary, but may be beneficial before planting up lalang-covered slopes, on which the soil is frequently friable and a poor water retainer.

Manuring. Manuring has hitherto scarcely been practised; and, except on worked-out tapioca, gambier, or pineapple lands, Hevea has done remarkably well without the application of manures or artificial fertilisers. No experiments are available showing the effect of manuring on yield; and, taking into consideration the almost universal response of yield to thinning-out met with in Malaya, it seems improbable that good results are likely to accrue generally. The collection of latex involves the removal of negligible quantities of essential plant foods from the soil (e.g. a crop of 500 lbs. of dry rubber removes less than 2 lbs. of phosphoric acid P_2O_5), and there seems no strong likelihood that manuring will have to be resorted to generally for a long period, except in cases where, owing to the previous history of the area, the soil has become exhausted, or on areas on which rubber should not have been planted on account of original poverty or poor character of the soil.

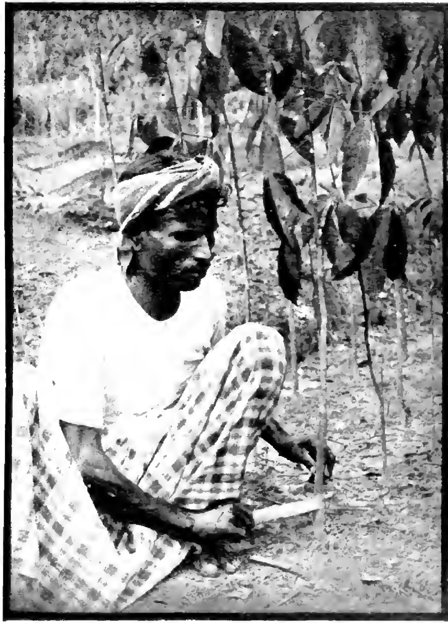
In some cases it has been possible to correlate poor yields with the condition of the sub-soil; in such cases, any application of fertilisers would be entirely useless and uneconomical.

THE application of large quantities of bulky organic manure, such as cattle manure, would almost certainly be of value on some soils, which, owing to their previous history and cultivation over a period of many years prior to the cultivation of rubber, are lacking in organic matter and nitrogen; but, unfortunately, such manure is available only to a small extent in Malaya. Good results, however, are said to have been produced by applying nitrates during the wintering season and field experiments on these lines are required in Malaya.

Liming. The soils of Malaya are, as a whole, acid—some strongly so—but there is no evidence that acidity, as such, is injurious to rubber, although the resultant inferior soil texture may be. For this reason, improvement of mechanical condition by the addition of quantities of lime, small in comparison with the "lime requirement" (i.e. the amount required to neutralise the acid present) is frequently found to be beneficial. It would often be decidedly dangerous to apply the full amount of lime indicated by routine analysis.

Conservation of Soil. The prevention of soil wash on undulating and hilly land is to-day one of the most insistent problems confronting rubber growers. Wherever possible on such land cover crops should be established; and, in addition or as an alternative, if the slopes are at all steep, silt pits, terraces or bunds should be constructed.

SILT pits are trenches, usually about 2 feet deep and 2 feet 6 inches wide and 6 to 8 feet long, so situated that all but the heaviest storm water with the suspended washed soil is caught and absorbed. The capacity of the silt pits should be sufficient to



Bud-grafting Hevea Seedlings.

Budded Stump, Four Months after Budding.

retain the heaviest rainfall during any period. A somewhat common error is to place the pits too near the foot of the hill, thus allowing a considerable movement of soil from top to bottom.

Terraces and bunds are probably better adapted to extremely steep slopes and should be laid down with a due consideration of contours.

In terracing, the establishment on the slopes of the terraces of a suitable cover crop or of weeds and grass other than lalang, should be carried out. A method of conserving soil which has been practised on estates in Sumatra and on at least one estate in Malaya is that of bunding.

The bunds are constructed by digging contour pits; the soil from these is used in the construction of a series of bunds, the site and frequency of which are determined by the slope of the land. After the main bunds are constructed, careful watch has to be kept, after heavy rainfall, in order to deal with any particular points, such as the heads of the ravines, which require special treatment. These methods, applied to undulating and hilly land, are of value not only in the conservation of the surface soil, but also in the retention of the rainfall *in situ*, an important factor in rubber cultivation.

It is important, however, that such methods should be applied if possible at an early stage in the planting up of an estate and not after much of the surface soil has already been removed.

It is important to realise that wash removes the entire top soil and not merely certain constituents; consequently the damage cannot be entirely repaired by manuring.

In addition to the operations described above for the conservation and improvement of soils, others which are connected with the trees and their yields, such as density of planting and thinning out, have to be considered.

Density of Plantation. On land which has not been completely cleared of jungle timber and stumps, 120—140 trees per acre should be planted in order to allow for losses by root diseases. Where clean clearing has been adopted, and in the case of lalang land free from timber and stumps, the stand may be reduced to 100 per acre. It has recently been suggested that when budded stock is used, considerably wider planting may be adopted. This is, however, considered to be a distinctly risky proceeding in the present stage of ignorance of variation among such stock.

Thinning Out. Disease and accidents may be expected to reduce the stand of trees on uncleared land at the end of the fourth year to 100 per acre; following this will come the removal of obvious wasters (undersized bark-bound trees). This should give sufficient space for the next two years; at the end of this period, a certain number of consistently poor yielders will have been identified and removed, the stand thus being reduced to about 85 trees per acre by the end of the 6th year. Thereafter—if not earlier—disease should be the chief factor in thinning out and every precaution should be taken lest healthy trees which happened to be of moderate development and yield are removed, while diseased trees of better temporary yield and appearance are left, to die later, when every loss is serious. The ideal would seem to be 50 trees per

acre in the eighth, thirteenth to fifteenth year, after which accidents (lightning, wind, etc.) and disease may be expected to do all the thinning required.

ON clean cleared properties there is practical immunity from root diseases, but even on such areas tree to tree examinations are advisable with stands of 65 or less.

MUCH discussion is taking place at the moment on drastic and early thinning out by selection, the argument being that a small percentage (say 30) of trees yield a large percentage (70) of the total crop. No records have been taken over a sufficient period to give certainty of the constancy of yield on the part of these high yielders; on the contrary, it is fairly general experience in Malaya that exceptionally high yielders are to be regarded with suspicion, either as being already attacked by fungi or white ants or as being susceptible to Brown Bast. In any case, the response in yield to such drastic thinning would not be sufficiently rapid to compensate for a loss of 30 per cent. of the crop for a considerable period—while only a small decrease in harvesting cost (itself a very insignificant proportion of the whole) could be expected.

Tapping Systems. There has been decided improvement in tapping systems in that more conservative tapping methods are coming into general use. Single cuts on one third and one quarter of the circumference tapped daily, and the single V on one half the circumference tapped on alternate days are now the favourite systems, superimposed and half spiral cuts being relatively rare.

ALTERNATE day tapping is gaining adherents both on account of economy and reduced liability of trees so tapped to Brown Bast.

AFTER the first year of tapping, the alternate-day V cut may be expected to give 75 per cent. of the yield obtained from a cut on one-third daily. In the first year, the comparison is much less favourable to alternate tapping; and, where a quick return is of importance, the trees might be opened up and tapped for twelve months on a third, changing over to alternate-day tapping at the end of this period.

Conclusion. To sum up, the general trend of thought is now to regard plantations as valuable permanent properties and to treat them accordingly.

WHEN dealing with a slow-growing permanent crop, rash experiments are to be deprecated; and, above all, health of culture should be the main consideration. Phenomenally high yields, lasting for short periods only, would be of little use.

UNFORTUNATELY our knowledge of the physiology of the rubber tree and the relationship of the latex to the general metabolism of the tree is still small.

AT the same time, attention to problems connected with the breeding and selection of improved strains of trees in respect of yield and other desirable characteristics are not being neglected. It is desirable to emphasize, however, that work of this nature must be necessarily slow in the case of a plant such as the rubber tree.

Manufacture and Factory Methods. Consideration of the plantation industry as a whole over the past decade leads to the conclusion that there has been no intrinsic change in the method of preparation of raw rubber over the whole of that period. It is, however, obvious that the present marks a transition stage and the very near future will see alterations in many directions which may be fundamental in their effects. It has been recognised for many years that progress in this industry demands close co-operation between the scientist and the planter, but, owing to the unfortunate condition imposed by the European war and its subsequent economic disturbance, the question of existence in many cases diverted all attention from the future to the present. Those conditions are rapidly passing and the spirit of progress and development is becoming paramount again.

It must be acknowledged also that the period from which the industry is emerging has led to many alterations in manufacture of raw rubber which, although not radical, are of great importance. The problem of variability in plantation rubber which was at one time a distinct drawback to the use of this rubber compared with para rubber, in the opinion of many manufacturers, has now been almost entirely overcome; and it is safe to say that, if the middle man could be eliminated and the producer and consumer brought into closer touch the problem would be entirely overcome. The groundwork which has already been covered by the chemists particularly concerned with investigations into methods of preparation of raw rubber has been extensive, and it has been demonstrated that the vulcanizing properties of plantation rubber can be influenced to

such an extent by scientifically established methods of handling and treatment of the latex and subsequent treatment of the derived coagulum, that the advantages to the manufacturer of the vulcanized material are highly important. Recent publications on the work by Stevens, Whitby and by officers of the Department of Agriculture have added materially to the knowledge of the constituents of Hevea latex and the effect which those constituents have collectively and separately on the ultimate properties of raw rubber and its behaviour during and after vulcanization.

FURTHER, the extensive and increasing use of organic vulcanization accelerating agents, more especially in America, has given an entirely new aspect to many problems of the rubber industry. In any consideration of possible future changes in methods of preparation or even in improvements in details in the manufacture of the present types of plantation rubber, due regard must be paid to manufacturers' requirements. In this connection it is desirable, therefore, to direct attention to other types of variability met with in the factory at the present time.

COMPLAINTS have been made by manufacturers in respect of two other types of variability of the raw material. These consist of a lack of uniformity in the case of "breaking down" on the hot mixing rolls and in the properties of solutions prepared from the raw rubber.

NO investigations have yet been made to ascertain the cause of these types of variability, which are probably connected either with the state of polymerisation of the caoutchouc in the raw rubber, or

with differences in the amounts of the so-called "impurities" or non-caoutchouc constituents, which are invariably present in the commercial product.

It is fitting to draw attention in this connection to the need which exists for the collaboration of the scientific workers in the tropics with those immediately attached to the consumers. All investigation work is useful but it is of vital importance to the plantation rubber industry and eventually to the entire British rubber industry to reap the earliest fruits of scientific investigation by co-operative work in which both producer and consumer can participate.

The price of raw rubber depends on the laws of supply and demand, and consequently any new method for the production of raw rubber, even though it produces a fundamental improvement in the intrinsic quality of the rubber for vulcanization, cannot become an economic proposition for the producer until a demand by the consumer has been established. The latter is, for the most part, absolutely unconcerned as to the development of new processes on the plantation or new types of raw rubber benefitting the planter, but strives rather to check any changes in the properties of a raw material which he has learnt to know in one form, and to handle which he has adapted his machinery. Thus a state of affairs has been created which will only be altered by the closest scientific and economic co-operation of planter and rubber manufacturer.

The Americans have already taken an important lead in this respect. The Hopkinson process for the preparation of desiccated latex or "L.S." (latex sprayed) rubber, depended, for its establishment on an industrial scale, on the consumption for vulcani-

zation in New York of a special type of whole rubber produced in Sumatra; the consuming Company and the producing Company being under the control of one parent organisation. The same organisation has now commenced operations in Selangor, and by its activities bids fair to prove to the industry as a whole many advantages in preparation etc., which this "latex sprayed" rubber possesses over standard 1st latex crepe and sheet.

THE undertakings which the same organisation has also entered into for shipping latex direct to the U.S.A., in connection with their industrial applications of Hevea latex direct for impregnating fibres with rubber, indicate the successful establishment of another very important technical use for this commodity.

IN a much smaller degree but along similar lines a British Company of manufacturers is developing the application of what may be regarded as latex vulcanization, by the adoption, on a rubber estate in Malacca, of the process invented by Dr. Schidrowitz for producing vulcanized rubber direct from latex.

COMBINATIONS of the ordinary hot vulcanization process with raw rubber production on the estate, although successful in one or two instances, cannot be regarded at present as particularly significant.

Appearance and Quality. Unfortunately, at the present time and for some time past, the principal factor which has any influence on the market value of the raw product is its appearance irrespective of the intrinsic quality.

WHILE a good appearance undoubtedly indicates care and supervision in preparation, it does not necessarily follow that appearance is correlated with the

TERRACING.

real quality of the raw material, or that certain so-called defects are in any way indicative of inferior quality. For example, the defect known by the brokers as "rust" on smoked sheet is certainly not connected with any inferior quality in the raw material, while the treatment of lower-grade rubber such as lump, cup washings and tree scrap with solutions of sodium bisulphite and sulphuric acid in order to obtain a rubber of paler and more even colour undoubtedly lowers the quality, although such rubber obtains a better market price on account of its appearance.

FURTHER, much pale-coloured native sheet, probably prepared by the use of alum, is converted into blanket crepe in Singapore and fetches a higher price than the darker native sheet which is coagulated with acetic acid and which, on conversion into blanket crepe, has a darker colour. In this case intrinsic quality is certainly not correlated with the appearance. The only point which concerns the individual producer at the present time in connection with the preparation of the raw rubber, is the appearance of the rubber and its superficial valuation by the broker. For some time past, nearly all samples received for investigation have been sent on account of such defects in appearance as bubbles, "rust," streakiness or dullness in crepe, yellow colour of pale crepe, "spot" disease and a few others.

CONSIDERABLE information is now available in connection with the causes of, and remedy for, all these defects. A good superintendent of the estate factory, who is capable of applying advice given in written instructions or in the literature already published, should be capable of dealing with these problems.

It is still unfortunately a fact, however, that the same problems are continually being raised with requests for advice, which appears to indicate that much of the time which has been devoted by scientists to the elimination of the superficial defects might have been spent to better advantage in other directions.

Coagulation. With the exception of native sheet, and possibly in the case of one or two large estates, all latex is coagulated with acetic acid, nor does it appear probable that any other coagulant is likely to be substituted.

Recently the coagulation of Hevea latex has been made the subject of some further investigations by the Plant Physiologist of the Department of Agriculture and the published results have led to several important modifications of previously established views as to the deleterious effects of certain chemicals as coagulants.

The chief improvement which has taken place during recent years on large estates is the coagulation of latex in bulk in the preparation of both sheet and crepe rubber, which has resulted in much greater uniformity in the raw material. No special recommendations are necessary at the present time in this connection.

Manufacture of smoked sheet, due to the coagulation of latex of constant concentration in bulk in large divided tanks, has without doubt been considerable. The ideal type of tank, particularly in respect of materials used in construction, has yet to be found and the preparation of sheet in deep

tanks is attended with certain defects, particularly bubbles which affect its market price, far more than in the case of sheet coagulated by the older method in separate shallow, enamelled pans.

Tank coagulation has also necessitated the general use of the anti-coagulant and anti-ferment Sodium Sulphite, the chief effect of which is to reduce bubble formation, since the bubbles are produced by fermentation. Bubble formation is greater in tank than in pan coagulation on account of the fact that the coagulation of latex in deep tanks is partially anaerobic, under which conditions bubbles, due to the formation of gas from the decomposition of the carbohydrates in the latex, are produced.

Great care must therefore be taken that the tanks do not become "sour," and they should be washed periodically with a dilute solution of formalin, and the dividing partitions treated similarly or exposed occasionally to the sun.

Cement tanks, lined with glass, and with glass or aluminium partitions, are now on the market and would appear to be the most suitable type, preferable to the wooden tanks lined with glazed tiles, with wooden partitions, now commonly in use.

The important points, in connection with the preparation of smoked sheet, to which attention should be directed are, elimination of "rust" and ventilation of the smoke house. The elimination of "rust" must be effected, on account of the broker's prejudices, although it does not affect the real quality of the rubber. "Rust" is due to the exudation of serum products from the interior of the sheet, which evaporate on the surface and usually form a thin

film which sometimes gives the rubber a wrinkled glossy appearance, especially in the depressions on a "diamond" marked sheet. When the sheet is stretched, the film is broken and appears as a brown rusty deposit. According to some Dutch scientists the film is caused by the bacterial decomposition of the serum products which exude and evaporate on the surface.

Manufacture of Pale Crepe. The manufacture of pale crepe by the use of sodium bisulphite to prevent the normal or natural darkening of the rubber, which is otherwise caused by the action of the oxidising enzyme on certain substances almost invariably present in Hevea latex, calls for no remarks.

THE detail connected with the preparation of this type of raw rubber has been so thoroughly mastered in most well run plantation factories that the product can be guaranteed to a very sharp standard of uniformity and appearance. That the consuming manufacturer of vulcanized goods is not materially benefitted by this elaborate care on the part of the producer seems to be particularly deplorable at a time when the British rubber world as a whole, and the planting community in particular, is so severely handicapped in all efforts towards the re-establishment of improved industrial conditions.

Manufacture of Lower Grades. With the present ratio between production and consumption of rubber and the low market price of rubber, the only lower grade rubber which appears to be worth preparing is that composed of the lump, washings and skimmings and picked tree-scrap, which can be mixed and converted into one grade.

A lighter coloured product can be prepared by soaking the fresh material, as soon as possible after collection, in a bath of sodium bisulphite and acetic acid, followed by a similar soaking of the crepe immediately after machining. This will improve the colour and market value, but not quality.

Packing of Rubber. In spite of recommendations and the invention of other suitable methods of packing, the greater part of the rubber in Malaya is still exported in wooden cases; and no precautions, such as lining the boxes, are taken to avoid contamination of the rubber with dust and splinters from the cases. For local transport to Singapore, however, collapsible canvas cases are employed by some estates and found to be satisfactory and economical.

Two recent inventions consist of cases constructed of a good quality lower grade crepe, or of the dried leaves of the "mengkuang." The market objection to such packing appears to be that the rubber in the lower packages, when in the hold of a ship, becomes consolidated to a solid block owing to the weight of the packages above. Apart from this, such packing material would appear to be very satisfactory.

It is, however, surprising that no extensive attempt has been made generally to line the inside of the ordinary wooden cases with a good lower-grade crepe or even to place a number of the sheets in the box in such a manner that a rubber lining composed of single sheets is formed, which would protect the whole of the remaining rubber packed in the box. However, the producer can probably scarcely be blamed, since, even if he took this trouble, he would not necessarily obtain a better price for his product.

Future Possibilities of Manufacture.

It is not possible to forecast any radical changes in the types of "first latex" rubber which may be marketed generally in the immediate or more distant future. The value of "slab" rubber, on account of its specially rapid vulcanising qualities combined with its general superiority as compared with the sheet and crepe, is possibly discounted to a great extent by the remarkable increase and extended use of numerous organic vulcanization accelerators now on the market.

It has, however, been stated by competent authorities that this increased use of accelerators, and particularly the exceedingly powerful types now being evolved, is not altogether without disadvantages to the manufacturer; in consequence of which the production of naturally fast vulcanizing uniform rubber would be well received in the manufacturing industry. Supporting this there is a knowledge of large contracts by a certain progressive Company which were maintained throughout 1923 for a guaranteed type of rubber which vulcanised in an ordinary 9:1 rubber-sulphur mix at 4 times the rate of 1st latex standard crepe and gave a superior vulcanised product. The consumers paid a higher price for the commodity than the ruling rates for standard crepe and the vending Company's production costs were lower than they would have been if their product had been in the ordinary form.

In addition to this it has now been proved that, by careful collaboration of the engineer and the chemist, and by the utilisation of existant plant only, a fast vulcanising, improved type of raw rubber can be produced in crepe form which also possesses the superficial qualities of standard 1st

latex crepe for at least 2/3 the factory costs of standard crepe. What further improvements could be effected in return for capital outlay on plant alteration it is only possible to estimate.

WHEN it is realised that the present most modern development of latex sprayed rubber requires the erection of expensive and patented plant for operation on an industrial scale and then yields a product which does not appear to possess the vulcanising properties of this matured crepe rubber, the prediction of future developments is fraught with uncertainty. Rubber which has been produced by a process which permits of maturation does undoubtedly possess enhanced vulcanizing properties; it remains to be seen whether the general manufacturing consumer is willing to pay for the improvement and whether the producer is prepared to consider the production of the raw rubber as involving factory problems which demand the attention of highly efficient chemical and engineering control with less conservative ideas than formerly if the plantations are to benefit thereby.

WHATEVER method of preparation may be adopted in the future, one fact appears certain, viz., that the fuel problem in connection with the manufacture of smoked sheet will sooner or later become critical. For the present, all the wood being used for this purpose is derived from old jungle stumps or timber on the estate which it is desirable to clear, or from the rubber wood derived from thinning out, but this will not be the case in the future. In the collection of figures obtained on behalf of the Forest Department it has been estimated that approximately 220,000 tons of wood were consumed in rubber factories during 1919. These figures are based on

the consumption of one ton of wood for every 185 lbs. of rubber. The consumption of wood may therefore be estimated at rather more than twice the output of rubber.

It would appear advisable, therefore, to direct serious attention to this problem and to state that, in the not distant future, some other method of preparation of the raw product will have to be considered, which will eliminate or considerably reduce the large amount of fuel consumed in the smoking. The shortage of wood fuel, apart from its actual cost, may have an important influence on the method of preparation of raw rubber in the future.

Statistics. Rubber was first commercially planted in Malaya about 1895; since then, though checked by the slump, expansion has been steady and rapid.

Figures for the last few years show:—

	Acres of Rubber Planted.		Rubber Exported from Malaya.**	
Year.	F.M.S.	S.S. & Unfed. M.S.	Tons.	Value ($)
1920*	—	—	182,059.21	36,074,278
1921	1,234,951	Approx. 1,000,000	169,429.06	12,898,345
1922	1,234,951	„ 1,000,000	248,131.12	18,685,828

* No reliable figures previous to census of 1921.

** Includes re-exports.

The F.M.S. acreage is made up as follows:—

Estates over 200 acres	696,041	acres.
............100 and under 200 ac.	68,959	„
.... 25...........100 ac.	64,296	„
.......under 25 ac.	405,655	„
	1,234,951	acres.

Sarawak Bean (Dolichos Hosei), as a Cover-Crop under Young Rubber.

THE proportion of small holdings to large Estates in the Straits and Unfederated Malay States is certainly higher than in the F.M.S.

Labour. Figures of labour on estates employing more than 100 labourers may be of interest. A very high proportion of the total are employed on rubber estates.

	Indians.	Javanese.	Chinese.	Others.	Total.
1920	186,876	8,918	40,866	5,838	262,498
1921	133,313	7,997	31,803	4,784	177,897
1922	150,336	6,020	32,260	6,448	195,564

THE large drop in 1921 is another aspect of the slump.

MALAYAN SERIES No. IV.

CEREALS.

British Empire Exhibition,

London. 1924.

Price 20 cents or 6d.

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CEREALS.

SINGAPORE:

FRASER AND NEAVE, LIMITED, PRINTERS.

1923.

Pounding Rice.

Cereals.

AS agriculture is tending to take a progressively more important position in the industrial life of Malaya, more attention must be paid to the fundamental requirements—food, shelter, clothing—of our agriculturists and the labouring classes.

THESE fundamental necessities, usually obscured in importance by the vast superstructure of conveniences, luxuries and the ordered security of modern civilization, only assume their true values whenever humanity is overwhelmed by a terrible calamity such as the Great War or the more recent earthquake in Japan.

CEREALS form the staple diet of all the toiling millions of the world's workers and their importance as the most valuable of economic crops has been recognised from earliest times.

WE read of their cultivation more than 4,000 years ago, and their significance in the rise and fall of Empires right down to modern times has always been forced upon us. Neither public works nor industrial pursuits of any kind can be carried on without ample supplies of the "staff of life" for the labouring masses, and the price of cereal food is a basal factor in every possible undertaking.

DURING the years 1917 and 1918 the problem of local food supplies greatly perplexed the Government in Malaya because the country was dependent largely on imported cereals, which became alarmingly scarce on account of restricted shipping and because of the increased European demand for rice, so that the sources of supply were unable to cope with the enormous demands. Hence it became necessary to

increase the local production of food, and various measures were adopted to render land the more readily available to agriculturists for cereal and other food crops. These measures, combined with the urgency of the food situation, resulted in comparatively large areas being cultivated temporarily with food stuffs.

WHILE these efforts were useful in increasing local production they fell far short of anticipations because of lack of knowledge regarding the special requirements of each particular crop and shortage of rain.

Rice. Rice is the chief cereal crop in Malaya; indeed, the only cereal of real economic importance. It is the staple diet of 99% of our population and yet the country only produces five-eights of our consumption. Furthermore, only 16% of the population is engaged in rice production. This is an undesirable state of affairs, as will be readily acknowledged by all who experienced the rice shortage which was so keenly felt a few years ago. The Government is fully cognisant of the situation and is endeavouring to further the local rice industry in every possible way. Much is being done in a quiet way by District Officers who aim at getting all suitable land in their districts planted up with rice each season, and assist in repairing water courses, dams, etc. The Irrigation Department strives to find irrigable areas and to establish water control to render such areas independent of rainfall as far as possible. The Agricultural Department aims at the production and distribution of good strains of seed and improved methods of dealing with cultural and other matters connected with the crop.

It is not generally known that the average area planted with rice in Malaya amounts to 669,262 acres annually, distributed as shown in the following table:—

Province or State.	Area in acres.	Area under rice.	% of total area.	Population 1921.	Area under rice per head.
Kedah	2,334,720	174,000	7.4	3,332,603	.51 acre.
Perlis	292,000	31,000	15.3	146,064	.77 „
Trengganu	3,840,000	10,800	.28	187,762	.07 „
Kelantan	3,756,800	175,050	4.66	320,585	.53 „
Johore	4,800,000	13,200	.27	80,424	.05 „
Singapore	145,000	Nil.	Nil.	85,941	Nil.
Malacca Town ..	3,240	Nil.	Nil.	599,055	Nil.
„ Country ..	460,400	27,622	5.9	39,075	.22 „
Dindings	117,120	720	.6	123,069	.06 „
Prov. Wellesley ..	179,460	33,500	18.33	130,341	.26 „
Penang Town ..	6,080	Nil.	Nil.	11,850	Nil.
„ Country ..	63,750	6,030	8.6	122,851	.15 „
Perak (including Krian)	5,040,000	119,505	2.3	30,671	.2 „
Krian	204,400	55,000	27.	425,912	.64 „
Selangor (K. L. Town)	11,000	Nil.	Nil.	282,234	Nil.
„ Country ..	2,037,000	18,410	.9	309,300	.06 „
Negri Sembilan ..	1,632,000	30,400	1.9	153,765	.16 „
Pahang	9,152,000	30,025	.3	40,087	.2 „
Total ..	33,870,570	669,262	1.98	338,558	.204 acre.

THE above table shows that the area of land per head of population under rice is only about one-fifth of an acre, whereas roughly half an acre is required to support one adult for a year. Thus, the only self-supporting States are Kedah, Kelantan and Perlis, chiefly because Malays are predominant in these States.

THE area under rice varies slightly from season to season, the main cause of variation being the incidence of rainfall.

Irrigation. Water supply is the chief factor in rice cultivation, and irrigation on a small scale is a common practice, the Malays displaying remarkable aptitude in diverting small streams so as to get the maximum utility from them. Temporary weirs formed of logs, bamboos, matted sticks and earth are frequently constructed to deviate part of the water of rivers into distribution channels for irrigating fairly large areas. In many places the cultivation is dependent on the annual flooding of rivers. In other places various contrivances (water wheels etc.) have to be erected to lift water from lower levels. In some areas adjustable dams have been constructed and elsewhere fixed bunds serve to conserve the rainfall. Regular controlled irrigation is the ideal, but this condition only exists in a few areas of which Krian, comprising 56,000 acres, is by far the largest. Hill rice is absolutely dependent on regular rainfall during the growing period.

A Malay Water-wheel for Irrigating the Rice Fields.

Soils. The best rice soils are the rich, heavy, clay loams which are found most abundantly in the coastal regions and in the valleys between the hills.

SANDY and peaty soils must be rigidly avoided, though the latter type can be utilised provided that the peat is only a few inches deep and rests on a good clay foundation, and that the area is drainable. Sandy soils are useless for padi cultivation unless they contain a large quantity of humus and are well irrigated; but at the best, only poor crops can be expected.

Cultivation. There are two forms of cultivation (a) wet, (b) dry.

MORE than 90% of the rice grown in Malaya is grown under wet cultivation methods, since wet padi is very much more productive than padi grown under dry conditions.

(a) Wet Rice Cultivation. Generally speaking, the more tillage the land receives the better. The fallow grasses and weeds are usually cut down as the first operation. Then the land is either ploughed or dug over and the weeds are incorporated with the soil. Following this, water is run on to the land, which is then puddled by buffaloes or by rolling, raked free of weeds, and finally brought to a consistent muddy condition for planting seedlings. The seed is usually

sown in dry nurseries; that is, in soil which is not subject to inundation, though under certain conditions wet nurseries with two or three transplantations are employed. Planting is practically always done in 4—6 inches of water. The water helps the seedlings to stand erect until new roots have been formed, and is retained on the land until 6—8 weeks before harvest.

In very soft areas ploughing is dispensed with, the only cultivation given being a thorough clearing away of weeds and grasses. In many places a forked iron rod is used to assist in planting seedlings, to ensure that their roots are pushed well into the soil, and at the same time to obviate excessive stooping. Otherwise all planting is done by hand. The usual planting distance is 14 by 14 inches.

(b) Dry Rice Cultivation. There are, broadly speaking, two forms of dry cultivation. In the more common method the land is simply cleared of bush frequently burned over, and no attempt is made to remove large stumps or to till the land. Seed is sown, 4 or 5 seeds per hole, in holes about 2 inches deep spaced some 14 inches apart, the holes being made by a blunt ended pole. In the other form of dry cultivation the land is thoroughly ploughed and crossploughed; then raked, after which operation the seed is broadcasted at the rate of 6—8 gallons per acre. The crop is entirely dependent on rainfall for its moisture.

Harvesting. Harvesting is all done by hand labour, the crop being cut either by sickle or by using a peculiar crescent shaped knife with which each ear is cut separately.

Threshing. This depends on the method of harvesting. If a sickle has been used the padi is tied in bundles and beaten against a ladder placed in a large open tub. If the crop has been cut ear by ear, then threshing is generally done by treading the heaps of ears with the feet. Very occasionally, the heaps of ears are beaten with sticks, but this is a slower method.

Winnowing. Winnowing is most frequently done by using the natural breeze which blows fairly steadily during the day in normal harvest weather. Otherwise, simple wooden hand-winnowing machines are utilised; or, where these are not in vogue, the Malay women use shallow circular baskets and depend on their own dexterity to separate the grain from the chaff and straw by gravitation.

Crops. Seasonal variation naturally has a very marked effect on the crop from year to year, and the yields differ enormously from district to district in the same season. The following table shows the average annual crops for the last 10 years:—

State or Province.	Average area under rice.	Average yield per annum in gantangs.	Average yield per acre in gantangs. Wet.	Dry.	Average yield per head of population in gantangs.
Kedah	174,000	44,001,000	253	165	130
Perlis	31,000	5,340,000	192	162	133
Trengganu	10,800	2,000,000	200	151	130
Kelantan	175,050	32,436,050	193	162	105
Johore	13,200	1,424,000	160	76	5
Singapore	—	—	—	—	—
Malacca Town . .	—	—	—	—	—
„ Country . .	27,622	7,712,000	246	—	63
Dindings	720	84,000	135	102	7
Prov. Wellesley . .	33,500	9,310,000	282	151	72
Penang Town . .	—	—	—	—	—
„ Country . .	6,030	2,261,730	370	—	58
Perak (including Krian)	119,505	21,173,500	241	121	35
Krian District . .	55,000	13,869,000	267	90	161
Selangor (K. L. Town)	—	—	—	—	—
„ Country . .	18,410	1,424,000	145	57	4.5
Negri Sembilan . .	30,400	4,602,000	160	187	25
Pahang	30,025	4,223,000	163	104	29
Total Malaya	669,262	135,991,280	203	110	41

From the above table it can be seen that the average yield derived from wet padi is 203 " gantangs " per acre, that is, just over 1,000 lbs. of unhusked rice. It may also be seen that the yields derived from wet padi are approximately double those obtained from dry padi cultivation.

Milling. Chinese enterprise copes with the milling in areas which produce a surplus above consumption. There are 10 large power mills in the country, but there is rarely enough padi to keep them all fully running. Several large rubber estates have installed small power mills and purchase padi directly from the producers for milling, to supply their own labour with rice. The cultivators use 2 types of simple mills for milling for their own daily needs. One type consists in pounding the padi in a mortar either by hand, foot or water power, and in the other type the padi is hulled between revolving milling surfaces, the surfaces being made by cementing together a number of laths of hard wood in a matrix of hardened clay.

By-Products. Milling by-products are relatively unimportant. The bran and polishings are used as cattle, pig and poultry food, and the husks are burned as fuel for the power mills.

Pests. Pests, other than rats, are rarely serious unless the soil is poor or moisture is insufficient. Rats do an immense amount of damage annually and it is most difficult to induce the cultivators to adopt measures to exterminate these vermin. Poison and traps are effective if only the rayats would employ them properly. Birds are very destructive in small isolated padi areas but the cultivators take more trouble to counteract their depredations than they do those of rats. The chief

insect pests are stem-borers (*Schoenobius sp.* and *Diatraea sp.*), sucking bugs (*Leptocorisa sp., Podops sp., Nephotettix sp.*), mole crickets (*Gryllotalpa sp.*), and grass-hoppers. Eel-worms sometimes do a fair amount of damage in sandy or peaty soils. Stored grain is liable to suffer badly from various weevils, if no precautions are taken.

Manures. Manures are little used because of their high costs, though where natural manures like guano are easily obtained they are readily applied. Nitrogenous and phosphatic mixtures appear to be the best manures for rice under ordinary conditions and applications of burnt crushed bones are common.

Selection. The Department of Agriculture has succeeded in isolating at Titi Serong, the main Rice Experiment Station, several heavy yielding strains capable of giving increased yields up to 25% above yields derived from unselected seed. The selected strains are being distributed and cultivators recognise their value so that natural redistribution is taking place in many areas. The importance of increasing the local production of rice may be emphasized by the statement that Malaya imports annually $34,000,000 worth of foreign grown rice—rice which is not as wholesome as the local product.

Maize. (Zea Mays). Next to rice, maize is our most important cereal. It is never seen planted on large areas, but occurs in countless small garden patches scattered throughout the Peninsula, and it is impossible to collect statistics of areas and yields at the present time. It is a comparatively new crop in Malaya, but there is no reason why it should not gradually assume

the proportions of a field crop on a large scale, since varieties of it appear to suit all local conditions, though good crops can only be grown on good soil.

Soils. The best soils for maize are the rich, light, sandy loams which are found along the banks of most of our rivers; but any fairly open-textured soil, provided that it is well supplied with organic matter, is capable of producing a good crop. Peaty soil must be avoided and heavy clays are not suitable unless intensive methods of cultivation are employed, which, as a rule, are too costly.

Cultivation. The crop responds readily to cultivation, so that the land should be thoroughly dug over and cleared of all weeds and roots. The seed is usually dibbled into shallow holes 2 inches deep, spaced about 9—12 inches apart in lines, which are marked off at intervals of 3 feet. Generally 3 seeds are dropped in each hole and lightly covered with soil by the foot of the sower. Surface cultivation between the lines is advantageous throughout the growing period. Seed is rarely broadcasted.

Crops. The crop matures in 2½—6 months according to the variety. Yields depend entirely on the richness of the soil, freedom from the ravages of pig, and suitable weather, but an average rate of yield of 600 lbs. per acre may be expected from medium soils. The best soils, like those on the banks of the Perak River, are capable of yielding at the rate of 1,800 lbs. or more per acre. Two or three crops can be grown successively on the same soil with good results, but rotation of crops is highly beneficial. The cobs when ripe must be well dried and stored in closed receptacles, as they suffer badly from weevils.

Uses. The crop is either cut green for sale as a vegetable or permitted to mature. It is usually crushed into meal and eaten as a porridge, sometimes ground into flour to make bread, sometimes boiled whole, like rice, or eaten raw as a light midday meal. The stems and leaves make an excellent fodder. The crop is of considerable economic importance as a garden crop and is likely to become a much more extensive cultivation in the future.

Ragi. (Eleusine Coracana). The third cereal for Malaya is ragi, but after rice and maize none of the cereals are worth much consideration, except as emergency crops under special circumstances. Ragi proved most helpful during the rice shortage in 1917 in supplementing the restricted supplies of rice. Its great advantage is that it can be grown on very poor soils which would be quite unsuitable for rice or maize, and most estates possess small disused patches of land which answer this description.

It grows best on well drained loams and will not tolerate inundation. The soil is thoroughly cultivated and pulverised and the seed may be broadcasted or, better, transplanted from a nursery. The crop occupies the soil for six months and the yields depend largely on weather and soil conditions and the intensity of cultivation, but an average of 800 lbs. per acre is easily obtained, if precautions are taken to scare away birds.

When mature, the heads are gathered and the stalks are left in the soil to be eaten by cattle, or burned or dug out for the next crop. Threshing is done by beating piles of the dried heads with sticks and

the chaff and husks are blown away or separated by the dexterity of the women using shallow baskets. The grain is boiled whole, like rice, or ground into flour for baking.

Millets. Several millets can be grown successfully but are very favoured by rice birds which are extremely detrimental to the crops. These crops are at present of no economic import, since they are less nutritious compared with other cereals and less productive under existing conditions, though, like ragi, they may be useful in times of emergency.

If damage by birds is eliminated, millets can produce crops of anything up to 1,200 lbs. according to the attention given to cultivation.

Sorghum. Sorghum is another crop which growns well in Malaya under efficient cultivation, but which is of no economic importance. It yields about 1,000 lbs. of grain under good cultivation in fertile soil, but is generally entirely consumed by birds.

Job's Tears. (Coix Lacryma—Jobi). This crop is frequently grown by the aboriginal Malays (Sakai) in their hill clearings and is occasionally found on dry loamy land near river beds. There are hard and soft shelled varieties and the crop matures in 3—4 months, though harvesting is very prolonged on account of the unequal ripening of the grain on each stalk. It is dibbled into the soil at 15 inch intervals or, rarely, transplanted. It is of no economic importance and is inferior as a food crop.

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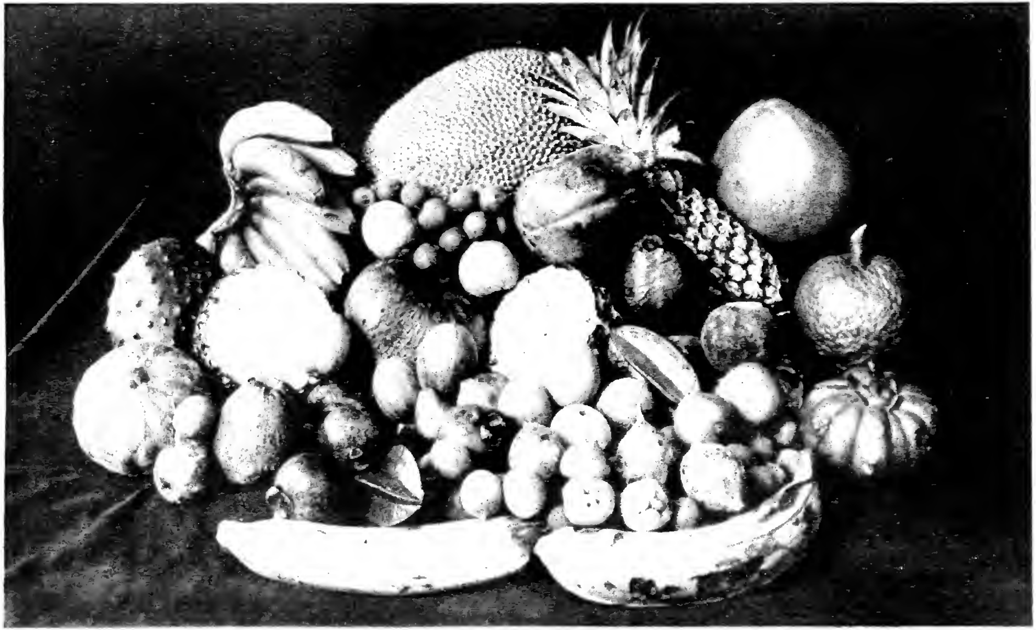

Malayan Fruits.

Fruit.

ALTHOUGH there are numerous varieties of fruits represented in Malaya, yet their quality, with very few exceptions, leaves much to be desired. Until recently, local fruit trees rarely received the necessary amount of cultivation and careful propagation, and it is to these causes that the present unsatisfactory position is due. The fact that, in spite of this lack of care, native-grown fruit trees frequently bear large crops, points to the conclusion that considerable improvement both of yield and quality is possible if scientific methods of cultivation were the rule rather than the exception.

CONSIDERED as a possible commercial undertaking, it is probable that a well managed orchard, in which good varieties of fruits were grown, would be successful. With the exception of pineapples and limes, no Malayan fruits have received the application of modern methods; but this, and the introduction of improved strains from other sources, are problems that require attention.

THE favourable qualities of selected trees can only, in many instances, be perpetuated by asexual propagation, and it appears possible that many of the fruits suitable for local cultivation may eventually be propagated by means other than seed. There are but few varieties that can be raised from cuttings with any degree of success; layering is little practised, propagation by seed or by marcottage being the usual system employed. The problem

requiring elucidation therefore is the nature of stock most suitable for planting. If seed be used, its source and subsequent treatment are matters of importance. The Department of Agriculture is engaged in raising a large stock of material suitable for planting out, in order to satisfy the constant demand of planters who experience considerable difficulty in obtaining young fruit trees. Work has also been carried out upon the importation of stock, with the result that the Avocado Pear and Brazil Nut are now successfully established in the country.

OWING to the difficulty of consumers in obtaining suitable fruit locally, there is a constant demand for imported fruits, of which oranges, litchis and mangoes are examples, in addition to jams and canned fruits of all descriptions. It is felt that the local supply should, in fact, supplant these imports, but this desideratum will only be attained when growers realise that they should market a first class product, thus obtaining a regular market and a higher price, instead of the low quality consignments which at present find their way to the local markets.

THE local fruit grower confines his attention to the more common varieties for which he finds a sale. Durians, Mangosteens, and Bananas are the best of their products, and are found in most districts; Rambutans, Pulasans, and Papaya being grown to a less extent. In Malacca, Penang and Singapore, good Chiku are produced, but inferior qualities are frequently sold in other towns.

THE following are the principal fruits for dessert purposes:—Chiku, Coconut, Duku, Mangosteen, Papaya, Pineapple, Plantain, Pomelo, Pulasan, Rambutan and Sugar apple.

FRUITS for stewing and preserving are:—Belimbing, Carambola, Carounda, Guava, Papaya, Pineapple, Pitangi, Roselle and Rumeniya: while fruits for the preparation of cooling drinks are Lime, Orange, Roselle and Soursop. Many of the above are admirably suited for jam making, but the practice of preserving is only undertaken by a few residents.

ORANGES are frequently grown, but the varieties are not generally of good quality, being too acid for dessert purposes and more suitable for cooling drinks. A Singapore resident has had marked success as regards the improvement of the Orange, and has now obtained a type with a good flavour for which there is a ready local market. There are some excellent Pomelo trees, the fruits having a delicious flavour, and very succulent; but on the average, the type grown is poor.

THE best soil for fruit culture is found in the plains and valleys formed from alluvial deposits brought down from the mountains. Undulating land is quite suitable, provided that there is little or no soil wash. Peat land is, as a rule, unsuitable for fruit cultivation. On flat land, good drainage is essential. Where damage is likely to be occasioned by windstorms it is desirable to plant strong-growing trees at right angles to the direction of the prevailing winds.

THE distance of planting is a matter of great importance. In this country, trees are generally planted too close together, and are frequently planted out from the nursery when too young. October and March are the most favourable seasons for planting. Land occupied by fruit trees should be clean-weeded, or a leguminous cover crop planted

over the area; and on no account should "lalang" (*Imperata arundinacea*) be allowed to occupy the ground. If clean weeding is adopted, the land should be tilled once annually; while light or heavy soils can be greatly improved by digging in a green manure during this operation. Mulching fruit trees during the dry seasons is seldom practised, but, by experiment, has been found of great value.

REGARDING the general care of fruit trees, attention should be drawn to the necessity for the control of insect pests and diseases. Pruning is almost unknown amongst natives, and is a point that requires further investigation.

Pineapples (Ananas Sativus). The pineapple is a native of Tropical America, but has been introduced into all tropical countries and is extensively grown in South America, West Indies, Cuba, Hawaiian Islands, Malay Archipelago and Queensland.

IN the Malay Peninsula the pineapple is grown both for dessert and canning purposes; the largest planted areas are to be found in the Island of Singapore, where there are several large canneries engaged in the preserving of the fruit. The local industry is very large, as will be seen from the following figures, which show the exports from Singapore during the past three years.

			QUANTITIES. Cases.	VALUE. $
Exports,	1919	..	255,873	3,286,001
,,	1920	..	446,890	7,177,976
,,	1921	..	662,360	6,210,383

THE rise in the value of exports in 1920 was due partly to the revival of trade, immediately after the war, and partly to the fact that supplies of

tin plate, practically unobtainable during the war, were more available. The principal country for export is the United Kingdom, but Canada, British India and the United States of America absorb fairly large stocks.

Cultivation of Pineapples for Canning. The variety most commonly grown for canning is a "Queen" type of pine, which is very similar to the "Red Jamaican Pine" of the West Indies. The fruit is very small, weighing from 3 to 5 lbs. and has an excellent flavour when tinned. The "Mauritius" and the "Smooth Cayenne" or "Kew Pine" are chiefly grown for dessert purposes.

Although the pineapple will grow on most soils, provided they are well-drained, it usually thrives best on the stiff clay types of soil. A rich soil appears to be unsuitable as it tends to develope the size of the fruit at the expense of the flavour. Pines grown on some of the poorest Singapore soils have the best flavour when canned.

Planting. The pines are propagated usually from the suckers which are obtained from the base of the fruit, the suckers being allowed to dry slightly in the sun before planting. They can be propagated also by means of the off-shoots or suckers from among the lower leaves of the plants. A common method of planting is in rows 5 feet apart, the plants being spaced 2½ feet apart in the rows, with a 6 foot path at every 100 feet. About 3,000 suckers are required to plant up an acre.
After planting, the fields require careful weeding, but are not generally manured. Fortunately the pineapple has few insect enemies and is not subject to many diseases.

Yield of Fruit. The pines begin to fruit at from 12 to 18 months, and during the first year of fruiting will produce one fruit per plant; but, with good cultivation, they should produce an average of about two fruits to each plant every year after the first year of fruiting. Under ordinary conditions the average yield of pines is about 4,000 to 5,000 per acre per annum.

THERE are usually two main crops during the year, the first in May and June and the second in November and December, but the crops depend very much on rainfall. When there is a spell of dry weather of long duration the pines do not fruit.
A properly cared-for estate, as cultivated in the Straits Settlements, will produce good fruits for 5 to 6 years, after which the pines gradually become smaller, and it is usually found necessary to remove the old plants and replant strong fresh suckers.

Canning. The pineapple canning or tinning industry is in the hands of Chinese merchants. In the Straits Settlements, the pines are always peeled and cut by hand, as hand labour is found to be more economical. The peeler wears a rubber glove on the left hand as a protection from the juice of the fruit. After peeling, the pines either whole, in slices or in cubes are placed in tins, which are filled either with water or syrup. In the case of whole pines, the cores are removed previously, if required, by a tin tube which is pressed through the centre, but most pines are tinned without coring. The syrup consists of about 3 parts of sugar to 100 parts of water, but is varied with the ripeness of the fruit. After the pine is put into the tin, the tin is soldered up and a number of tins are placed on a wooden rack slung on wires

Pineapples (Ananas sativus), Interplanted with Young Rubber.

and plunged into a rectangular tank of water heated by means of steam-coils. The tins are boiled in this tank for ten to fifteen minutes in the case of the smallest tins, and up to an hour for large tins, the biggest tins weighing 5 pounds when full. After removal from the boiling water a puncture is made in the top of the tin with a hammer and punch; in large tins two punctures are made. This is done to allow the steam to escape; the holes are resoldered and the tins plunged again into boiling water for about nine minutes. They are then labelled and packed in boxes for export.

THE forms manufactured for export are (1) whole pines, (2) sliced pines, and (3) chunks or cubes. The most popular size is the 1½ lb. tin, which is shipped in wooden cases containing 4 dozen tins.

Machinery. The greater part of the machinery employed in the canning factories is necessary for the manufacture of tins, and consists of tin plate cutting machines, cover and bottom presses, and rolling machines for making the tins. The tin plate is imported from the United Kingdom and the tins made completely in the canning factories in Singapore.

General. Owing to the main crop maturing in two comparatively short seasons during the year, the working of the factories is very irregular and it is necessary to employ much additional labour during the height of the fruiting seasons. The prices paid for pines are somewhat high at the beginning and end of the seasons, but they are, as a rule, so low during the height of the May/June crop that the grower gets practically no profit.

There is usually a small supply of fruit available between the main cropping seasons, and the canner has to rely on this to keep his factory running during these periods. The supplies are usually supplemented by purchasing fruit from outside sources where the fruiting season does not coincide with that in Singapore, and fairly large quantities are shipped to Singapore from Port Swettenham: when it has to be transported such long distances, the fruit is cut just a little under-ripe. Towards the end of 1921 there existed about six canning factories in Singapore, two near Johore Bharu on the mainland, and one in Selangor.

Bananas (Musa Sapientum). The banana or plantain is to be found cultivated throughout the whole of the tropics on account of its highly nutritious fruit. It is undoubtedly the commonest fruit on the local markets, where it is sold chiefly for dessert purposes. A large number of varieties is cultivated, and it is therefore impossible to describe them all in this place.

Cultivation. The banana flourishes best on heavy soils fairly rich in organic matter, and in moist situations, providing the soil is well-drained. The plant is liable to be damaged by heavy winds and should not be planted in exposed situations.

It is propagated by suckers, which arise from the roots of the parent plant. Suckers for planting should be selected only from vigorous plants. The land selected should be cleared and then carefully holed and lined ready for planting. The holes should be fairly large and filled up with good soil, cattle manure or humus. The average distance of planting is from 10 to 15 feet apart, according to the particular variety to be planted. If planted in dry

weather, a mulch of cut grass should be placed round the suckers to prevent excessive evaporation. Weeds must not be allowed to grow immediately round the plants and the soil should be frequently stirred.

THE banana plant appears to utilise a large proportion of potash from the soil and all parts of the plant are rich in potash. In Queensland the application of potash fertilisers has been effective in increasing yields.

THE first bunch of fruits is produced about a year from the date of planting, but this depends upon the variety grown. The plant will throw out several suckers, forming a clump, but only four or five of these should be allowed to grow. After removing the fruit the stem should be cut down to allow the subsidiary suckers space to expand. With good cultivation these will soon bear fruit and the plant will continue to be productive for from four to six years, during which time it will yield an average of two bunches of fruit per annum.

Banana Flour. A new industry, which has recently been started in the West Indies, is the manufacture of banana flour.

ANY kind of banana or plantain is suitable for the preparation of banana flour, but for economic purposes, the variety which produces the largest weight of fruit (excluding the skin) should be grown, apart from other considerations, such as liability to attack by pests and diseases. In this country the *Pisang Raja* on account of the size of its bunches, size of fruit and high productivity, is recommended as the most economical variety for flour.

THE bunches should be cut when about three-quarters grown, otherwise the fruit will become too ripe and the starch be converted largely into sugar. THE bananas are peeled, sliced thinly with a nickel, bamboo or other knife which does not darken the fruit, and the slices laid on wooden trays in the sun to dry. Under good conditions the drying takes from two to three days. The dried slices are crushed in a corn mill or pounded in a mortar, and sifted through fine muslin.

ON a large commercial scale, artificial drying is resorted to; this is carried out preferably in vacuum driers at a low temperature, or in special chambers or rooms in which the peeled and sliced bananas are placed on trays on endless travelling belts or conveyors, and dried by forcing or drawing hot air through the chambers.

Uses. In this country large quantities of bananas are consumed either as dessert or cooked as food, and very little, if any, fresh fruit is exported.

A large quantity of fresh fruit is consumed in the United Kingdom, where it is estimated that over 9,000,000 bunches are imported annually, principally from the West Indies.

A new and rapidly increasing trade in the West Indies is now being carried on with dessicated bananas, which are used in the manufacture of banana flour, the latter having the peculiar flavour and odour of the fresh fruit.

BANANA meal or flour is highly nutritious and very digestible, and is used largely as a food for invalids and infants.

General. The banana can be produced so cheaply in this country that it should be possible to ship fresh fruit to the Southern and Western States of Australia; and, provided ships on the Singapore—Australian route were fitted with special refrigerating space, there appears to be no reason why a profitable trade should not be developed between the two countries. The fruit can be purchased on the local markets at considerably less than a cent each and, if delivered in good condition, could probably be sold in Australia at a price equivalent to 5 or 6 cents.

THERE is at the present time a small import duty on bananas in Australia, but in spite of this, fairly large quantities of the fresh fruit are now being exported to that country from Java.

Limes (Citrus medica, var. acida). The lime is cultivated to a greater or less extent in all tropical countries for its acid, juicy fruit, which is used principally in the manufacture of cooling drinks. It is grown as a commercial product in the West Indies, and the export of concentrated lime juice and citrate of lime forms the chief industry of the island of Dominica.

FORMERLY, citric acid was obtained from the Sicilian lemon (*Citrus medica, var. lemonum*), but during recent years the lime has to some extent taken its place.

THE lime plant requires careful attention in its cultivation, as if grown under unfavourable conditions it is subject to severe attacks by both insect pests and fungoid diseases, which will affect the yield of fruit to such an extent as to render cultivation on a field scale unremunerative.

Cultivation. A rich loam soil on flat ground is considered the most suitable for the cultivation of limes, although it will thrive on most soils except stiff clays.

THE plant is propagated from seeds or cuttings, but budding and grafting are frequently adopted. The seed is usually sown in carefully prepared nursery beds, which should be 5 feet wide, slightly raised above ground, and shaded. The seeds should be sown in lines 8 or 9 inches apart, with an interval of 2 to 3 inches between the seeds in the lines; sufficient seed should be sown to allow for losses in the field. When the seedlings are four to five inches high they should be transferred to other nursery beds, where they are replanted 6 to 9 inches apart, the tops being nipped off to produce a thick well-branched tree. When the seedlings are about one foot high, they should be planted in the field. The usual distance of planting is from 15 to 20 feet apart according to the nature of the soil; the richer the soil the greater the spacing.

MATURE lime trees are not usually clean-weeded except for a small area round each tree, but the grass between the rows should be cut regularly.

CAREFUL attention must be given to pests and diseases and a sharp watch should be kept for plant parasites, which are very liable to attack the trees. Scale insects are usually the most troublesome pest.

UNDER ordinary conditions the lime tree commences to fruit at from three to three and a half years from the time of planting, and at six to seven years will give an average yield of 1,500 to 2,000 fruits per tree per annum.

Although the plant produces fruit throughout the year, fruiting is usually more pronounced during two periods, following the wet seasons.

It is estimated that, on well cultivated estates in the West Indies, one acre of limes will yield 24,000 lbs. of fruits, equivalent to 11,550 lbs. of raw juice, or 914 lbs. of citric acid. In addition, 65 lbs. of hand-pressed oil are obtained from the rind of the fruits.

Commercial Products. The products of the lime which are in demand commercially are:—

(1) *Green Limes.*—Consisting of specially selected fresh fruit.

(2) *Pickled Limes.*—Yellow selected limes, steeped in several changes of sea-water and shipped in casks of sea-water to which salt has been added.

(3) *Raw Lime Juice.*—Prepared by expression of the fruits and containing normally 12 to 14 ozs. of citric acid per gallon of juice.

(4) *Concentrated Lime Juice.*—Prepared by evaporating raw juice in either open or vacuum pans.

(5) *Citrate of Lime.*—Prepared by raising the raw juice to boiling point by means of steam coils in large, lead-lined, wooden vats, and neutralising the acid of the hot juice with milk of lime. The citrate of lime thus produced as an insoluble precipitate is allowed to settle and the clear liquor run off. The product is then dried by heating. In the preparation of a high grade product, further details in manufacture must be observed.

(6) *Essential Oils.*—Derived from the rind or peel.

(a) Hand pressed oil is extracted from the rind of the fruit in a special machine before crushing in the factory and (b) distilled lime oil is obtained from the raw juice by a preliminary distillation of the raw juice before evaporation in the preparation of concentrated juice.

Uses of Commercial Products. Fresh and pickled limes are used for the preparation of cooling drinks and for flavouring purposes; raw lime juice is used in the manufacture of lime-juice syrups and cordials. Citric acid, produced from citrate of lime, is used largely in connection with the textile and dyeing industry and in the manufacture of other fine chemicals, while the essential oils are employed in perfumery, as a flavouring for essences and confectionery, and in the preparation of scented soaps.

Citric Acid. Until recently the product of the fruit was exported from the West Indies in the form of raw juice, concentrated juice or citrate of lime, but attention is now being directed to the manufacture of citric acid in estate factories.

CITRIC acid is usually prepared by treating the citrate of lime with sulphuric acid, sufficient acid being added to convert the whole of the calcium citrate or citrate of lime into free citric acid, which remains dissolved, leaving the calcium sulphate formed in the reaction as an insoluble sludge. The solution of citric acid is filtered from the insoluble calcium sulphate sludge in mechanical filters, and the crystals of citric acid are obtained by evaporating the clear solution to a concentration at which the crystals will separate from the solution on cooling. The exact point is usually determined by means of hydrometers.

CAREFUL factory control and some experience are required in the manufacture of concentrated juice, and more especially in the manufacture of calcium citrate or citric acid, scientific chemical advice is necessary or desirable in the first instance, unless the factory superintendent has received preliminary training in connection with the manufacture of these products.

Possibilities in Malaya. One estate in Malaya has already taken up the cultivation of limes on a small commercial scale and it is intended in the first instance to manufacture concentrated lime juice, for which the necessary plant has been obtained. There should be a good Eastern and probably an Australian market for the products, although whether this country can compete with the West Indies in the European and American markets remains to be proved. The chief difficulty at present is the supply of a suitable wood for barrels. In the case of citrate of lime or citric acid, which are solids, this difficulty does not arise, since barrels constructed from suitable local wood could probably be made. Wooden boxes or cases would also be quite satisfactory for the packing of citrate of lime or citric acid for export. In the case of the liquid products, raw lime juice, and concentrated lime juice, the barrels would have to be of better construction and of strong wood to prevent leakage. It is not possible in this place to include full details of the processes of manufacture of the various products, but full information on this subject, including methods, machinery, and cost of plant required, can be obtained on application to the Department of Agriculture.

Vegetables.

THE Malay Peninsula is exceedingly well adapted to the cultivation of tropical vegetables, which can be grown more or less throughout the year. The quantity produced locally, though large, is not sufficient for the requirements of the country, consequently the inhabitants have to rely to some extent on the importation of vegetables from Java and China. There is ample room for extensive development in this form of cultivation, both on the hills and in the low country. Chinese small-holders and "Squatters" are the chief growers, and their plots are well distributed throughout the country; but, even in the neighbourhood of large towns, no well-known market garden is to be found. These Chinese obtain extraordinarily good results; but, unfortunately, their produce is not always grown in strict accordance with sanitary principles and therefore fails to command as large a market among Europeans as it would command, were it grown under better supervision. One is surprised by the immense trouble and care that a Chinaman takes in his garden, and the high state of fertility which is ultimately reached. He has an intimate knowledge of this branch of agriculture and uses it to considerable advantage, but his small capital limits him to production on a small scale, with only the simplest of cultural implements. The Tamil rarely grows more than is sufficient for his own requirements, while the Malay takes little or no part in the production of vegetables. The European

has developed rather more interest in the subject during the past few years, with the result that many are now to a certain extent independent of the market supply. Managers of rubber estates, as a general rule, have opportunities of making and maintaining a vegetable garden, but more advantage might easily be taken of these opportunities. It is unlikely that the European will ever grow sufficient to contribute to the market, but it is not improbable that he will finance the Chinaman to an extent which will enable him to use more modern types of implements and will induce him to grow more of those vegetables for which there is a European demand. The capitalist of the country looks mostly to Rubber and Coconuts as an investment and has probably never considered seriously the possibilities of vegetable culture. Around the large centres there is undoubtedly room for progress in this direction; and, considering the cost of importing vegetables from other countries, it would appear to be a profitable investment.

TROPICAL vegetables are well represented and of good quality but could without doubt be improved by selection. European vegetables such as potatoes, carrots, beet, etc. are almost entirely imported; they cannot be grown successfully on the low lands but there is ample scope for their cultivation on the hills, where they have been proved to do well. At the Government Gardens, Maxwell's Hill, Taiping, Perak, such vegetables have been grown satisfactorily for years; and, as other hill stations are developed, gardens of a similar nature will undoubtedly be established. In India and Ceylon vegetables are extensively cultivated in the hill-country, and the towns on the plains derive a fair

supply from this source. There seems little reason why Malaya should not do likewise. The demand for potatoes alone is sufficient to warrant the opening up of large areas.

In making a vegetable garden there are many factors which require to be taken into account. The situation should be an open spot, preferably on a slope facing east. A good water supply, conveniently situated, is essential. The type of soil is very important and Chinese market gardeners pay the utmost importance to the selection of land with abundance of humus. Deep loams or alluvial soils, rich in humus and moderately light, are most suitable and require the minimum amount of preparation. Sandy and laterite soils require heavy and repeated applications of organic manure. Clays, on the other hand, are too heavy, cold and damp, and are as unsuitable as barren sandy soils. It is not to be expected, however, that either very light or heavy soils, particularly the latter, will ever attain the same degree of perfection as a naturally well-balanced alluvial soil. One of the principal features in vegetable growing is the maintainance of a high class tilth; tillage makes the soil more porous and permeable to roots, enables vegetable and mineral matter to decompose more rapidly, promotes oxidation and stimulates the activity of the nitrifying bacteria, checks the growth of weeds and reduces evaporation of soil moisture. The depth of cultivation required will depend on the nature of the soil and of the vegetable grown.

Manuring is as important as tillage. Frequent applications of one or more organic manures, such as cattle manure, fish refuse, guano, oil cake, leaf

Malayan Vegetables.

mould, etc. are required in order to maintain soil fertility. Well rotted cattle manure is the best form of organic manure for vegetable cultivation.

THE judicious planting of successive crops, in rotation, is of considerable importance. A rotation of crops is resorted to in ordinary practice in consequence of the economy of manure and variation of root growth which result from this practice. Certain crops are subject to special diseases, and the eradication of such diseases is often effected by the introduction of other types of crops. Plants of the same order should not follow each other. Deep and shallow rooted crops should, as far as possible, be grown in succession. A leguminous plant should be included in the rotation. The source and storage of seeds must receive careful attention. It is of primary importance in the combating of insect and fungoid attacks to ensure that the plant is maintained in a vigorous condition by good cultivation. When practicable, hand picking of insects should be resorted to; this applies in particular to the numerous species of caterpillars which feed on stems and leaves. Several fungoid diseases do considerable damage and are kept in check preferably by strict plant sanitation. Good cultivation and drainage, judicious manuring, rotation of crops, isolation of infected areas, destruction of diseased plants or tissues, freedom from wounds, artificial watering and careful pruning when necessary, are factors which tend to reduce the possibilities of attack and spread of disease.

THERE are numerous factors which require to be considered in making a selection of vegetables for the garden. In small gardens a selection of edible leaf and stem vegetables should be grown as these

cannot be bought in the markets with any degree of safety. Of root crops, the sweet potato is the most important cultivated here; it is eaten by all nationalities in Malaya, particularly by the Chinese. There are numerous varieties; but, of the two commonly grown in this country, one reaches maturity in about three months from the time of planting, while the other takes six months. The former type is the more popular. An introduced variety, known as New Jersey Red, produces large tubers of excellent flavour. Experiments have shown that the largest crops of sweet potatoes are grown on land that has been ridged. This tuber can be grown on any moderately good friable soil. Propagation is effected generally by cuttings from semi-mature portions of the stem. As a sole crop, the ordinary early maturing variety will produce a yield varying from two to three tons per acre. The cost of growing a crop of "three months" sweet potatoes is approximately twenty-two dollars (Straits) per acre.

ANOTHER important root crop in this country is the Yam which can be grown successfully on comparatively poor land; a sandy loam is preferable, but deep tillage and good cultivation are more important than quality of soil. The greater or "ten months" yam (*Dioscorea alata*) is the species most commonly cultivated in Indo-Malaya. Cultivation is a comparatively simple matter. Propagation is from sets taken from the mature tubers. An average crop is about six to seven tons to the acre, costing from thirty five to forty dollars to produce. This root crop forms an important article of food both for Europeans and natives.

KELADI (*Colocasia antiquorum*) is grown to some extent by the Chinese. In the West Indies it is a well-known crop and is an important tuber vegetable.

THE Jerusalem Artichoke (*Helianthus tuberosus*), Sunroot, is cultivated locally and is a favourite vegetable with Europeans. Artichokes thrive best in moderately light rich soils, but do quite well when grown under less favourable conditions. Mature tubers are used in propagation. The crop takes from four to five months to reach maturity. A fair average yield as a field crop would appear to be about ten tons per acre.

THE Yam Bean (*Pachyrhizus tuberosus*) and Elephant Yam (*Amorphophallus campanulatus*) are worthy of mention as subsidiary root crops.

THERE is quite a variety of beans which can be grown on the plains; special mention might be made of the Lima Bean (*Phaseolus lunatus*) which has recently come into favour as a food crop in this country. The large-seeded varieties make an excellent vegetable either shelled from the green pods or dry. The lima bean will grow in any moderately good soil. Seeds of this bean have been distributed by the Department of Agriculture, F.M.S. & S.S., to many residents in the Peninsula; it is a prolific yielder and its cultivation should be encouraged in this country, where it does so well.

OTHER beans which do well in the low country are the French or Kidney Bean, Egyptian Kidney Bean, Four-angled Bean, Sword or Jack Bean, Cow Pea and the Pigeon Pea.

Some of the favourite native vegetables which can be grown successfully on the plains are the Gourd, Brinjal, Ceylon-Spinach, Chillies, Chocho, Endive, Ladies Fingers, Loofah, Lotus, Pumpkin, Shallot and Snake Gourd. Lettuce, Tomatoes, Onions, Maize, Parsley and Water-cress all do well in Malaya. Lettuce and Tomatoes are very favourite vegetables; and, as they can be grown so easily throughout the year, it is somewhat surprising to find comparatively few Europeans who cultivate them.

Comparatively little success is obtained at low elevations with the following vegetables: Asparagus, Beet, Carrot, Cabbage, Celery, Potato, Leak, Parsnip, Radish, Turnip and Vegetable-marrow, but all of these can be grown successfully on the hills.

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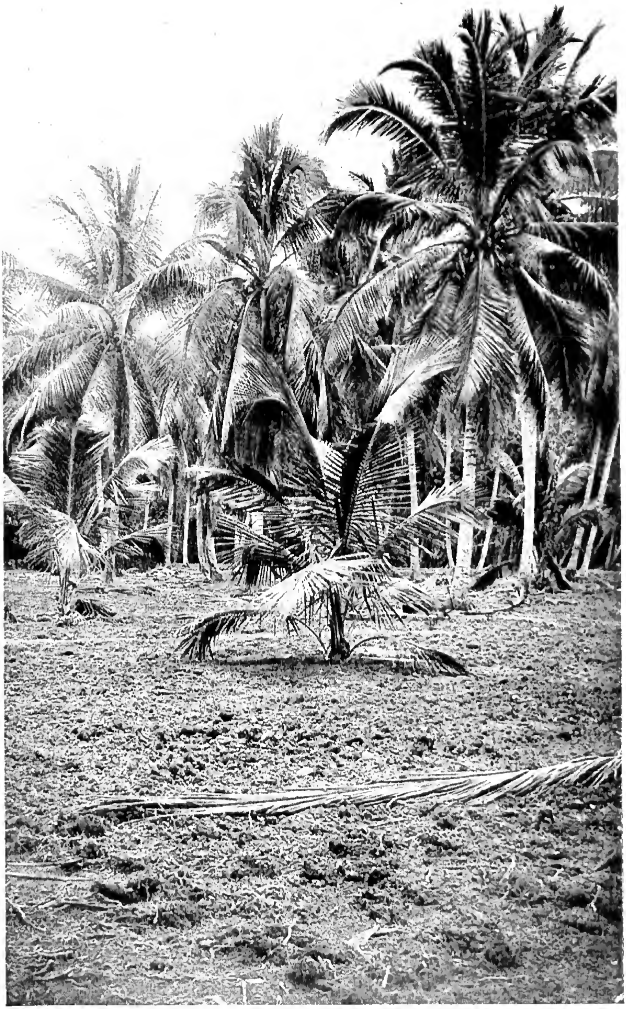

Coconut Estate, shewing Young "Supplies."

Oils and Fats.

ONE of the features of modern commerce is the provision of adequate supplies of those raw materials essential to mankind, not the least important of which are oils and fats. There is no need to insist on this; the numerous ways in which oils and fats are consumed in daily life, either directly or indirectly, are so familiar to all that the necessity of being assured of adequate supplies can be taken as vital.

UNDOUBTEDLY the greatest consumption of oils and fats is among the dense populations of the temperate zones, who are unable, by reason of climatic and other conditions, to supply their requirements, while the chief source of oil materials lies in the relatively sparsely populated tropical regions.

MALAYA is no exception to this; the chief oil-bearing plants grow well in this country but, up to the present with the exception of coconuts, little has been done as regards exploiting them. The chief reason for this is that the main interest of the country is centred in the production of plantation rubber; but, with the recent decline in the price of this commodity, there is reason to believe that more attention will be given to extending the cultivation of various oil-bearing plants, especially those which can be grown under similar plantation conditions.

IN this article, therefore, a short survey will be given of those oil-bearing plants which are being cultivated in this country, or with which experi-

ments are at present being carried out; together with brief notes regarding the methods in general use for the extraction of oils and their industrial applications.

Classification.—Before stating how oils and fats derived from vegetable sources are classified, it is perhaps necessary to state that the difference between an oil and a fat depends solely on temperature, for a fat when melted is termed as oil and an oil when solidified becomes a fat. An instance of the manner in which the temperature of a climate affects this nomenclature is seen in the case of coconut oil, which in this country is a liquid and would therefore be regarded as an oil, while in Northern Europe it is a fat.

OILS from vegetable sources are classified as either fixed or essential. By the term fixed is meant an oil which cannot be volatilised without undergoing chemical decomposition, while the opposite applies to essential oils which are sometimes known as volatile oils.

THERE is also a great difference, from a chemical point of view, between the two classes. The fixed oils and fats are mixtures of glycerides of fatty acids; that is to say, chemical compounds formed by the combination of glycerine with fatty acids, and which yield glycerine and soap when treated with caustic alkalis.

ESSENTIAL oils, on the other hand, consist of mixtures of highly complex organic compounds such as, for example, hydrocarbons (compounds of carbon and hydrogen), alcohols, aldehydes, and esters, which do not react with caustic alkalis in the same way as fixed oils.

It is advisable therefore, to describe these two classes separately, since the methods of extraction and the commercial uses are so distinct.

Fixed Oils. *Occurrence and Extraction.*—Fixed oils are found chiefly in the seeds of plants where, together with starch and proteins, they are available as food which would be required by the seed if allowed to germinate. The preparation of the oil therefore consists in an extraction from the seed, and is carried out by one of two methods, either by a mechanical process of submitting the seed to high pressure in a press or by treating the seed with chemical solvents which will dissolve only the oil.

When pressing oil seeds or nuts, the general method at present in use is as follows: the seeds or nuts are cleaned and decorticated if necessary, and the kernels converted into a pulpy meal by being passed between a series of rolls.

If the oil is to be used for edible purposes, the meal is then expressed in the cold, such oil dissolving the smallest amount of extraneous impurities from the seed. By pressing in the cold, only a portion of the oil can be recovered, so the cakes are disintegrated and the meal heated and pressed again. If the material is particularly rich in oil, or if the oil is viscous, this process may have to be repeated and a third expression carried out.

It will be seen that it is only possible with certain seeds, for example castor oil, groundnut and gingelly, to employ the cold pressing method; this would not be possible where the oil is solid at the ordinary temperature, as for example with palm

kernels or copra, or where the oil content of the seed is low, as in the case of cotton seed. In such cases, therefore, after leaving the crushing rolls, the meal is heated and pressed direct.

THE presses employed in modern oil expression practice are of the hydraulic type; they vary in design, the two chief types being the Anglo-American open press, and the closed cage press.

THERE are also machines in use called "expellers" which are designed to combine both the crushing and the preliminary pressing. These machines work on the principle of a screw conveyor, the raw material being fed through a hopper at one end and being forced out at the other through the annular space between the screw and the outer casing.

IN the second process the oil is extracted from the meal by means of hot or cold chemical solvents. The chief solvents in use are carbon bisulphide, benzene, carbon tetrachloride and trichloroethylene. Briefly, the process consists in allowing the hot or cold solvent to percolate through the meal contained in a series of closed vessels, when the solvent will dissolve out the oil. The solution is then transferred to a heated still in which the solvent is distilled off, leaving the oil behind. The solvent can be recovered and used again.

THESE two are not necessarily rival processes but are worked together, sometimes in the same mill. Thus, certain seeds can be crushed cold in order to obtain a high-class edible oil, and then treated by a solvent extraction process to recover the remainder of the oil, since with the latter process it is possible

to recover all the oil in the seed, whereas by pressure alone it is rarely possible to obtain more than 90 per cent. of the total oil content.

In general, it may be said that the method of expression is invariably followed if the cake is to be used as a feeding stuff, as the small amount of oil therein forms a valuable constituent. In the case of mouldy or damaged seed material, where the cake could not be used for this purpose, or where the cake cannot be employed on account of some poisonous principle, the solvent extraction process is to be preferred.

Application and Uses.—It would be difficult to enumerate all the uses of oils, but among the chief are the applications which they find in the manufacture of butter substitutes (margarine) and other preparations for edible purposes, soaps and candles, paints and varnishes, linoleum, leather and lubricants. To a certain extent the industrial application of an oil depends on whether it belongs to the drying class of oils. The surfaces of such oils, when exposed to air, film over or solidify; and this property, which is known as drying, is taken into account when selecting an oil for utilisation in the manufacture of paints and varnishes, the film produced forming the protective coating on the material treated. In all these applications, except in the case of soap and candles, the oil must be free from a large excess of fatty acids; otherwise it must undergo a preliminary refining process or be used as soap or candle stock, in which case the presence of free fatty acid makes little difference.

As stated above, the oil cake or meal remaining after extraction forms a valuable bye-product, either as a cattle food or fertiliser. It is more profitable

to use this residue as cattle food and to return it ultimately to the soil in the form of cattle manure. In the case of some seeds, for example, castor oil seed, this is impossible, since the meal or cake contains some poisonous substance, and can therefore only be utilised directly as a fertiliser.

Essential Oils. *Occurrence and Extraction.*—Unlike fixed oils, which occur almost entirely in the seed or fruit, essential oils may be found in various parts of the plant; the leaves, roots, flowers and bark; for example, in the case of the rose, the oil is obtained from the flower petals, while in lemon grass the oil is present in the leaf. Nutmegs contain both fixed and essential oils. Frequently, too, more than one essential oil occurs in a plant; thus in the case of the cinnamon tree, the bark, the leaves and the roots all yield different oils.

ESSENTIAL oils occur in plants generally in very small amounts; it is seldom that the yield of oil, calculated on the weight of fresh material, exceeds a few per cent., frequently it is less than one per cent.

THE methods employed for the production of essential oils may be classed as follows:—

(1) Steam distillation of the plant.

(2) Mechanical processes.

(3) Solvent extraction.

WITH regard to the first method, which is by far the most important, the distillation from the plant material is carried out by means of steam, all essential oils being readily volatile in the presence of water vapour.

The distillation is carried out in a still, connected to a condenser around which cold water circulates. The still is provided with a false bottom, on which the plant material is placed. Steam is passed through the still, thereby volatilising the oil. The mixture of oil and steam is condensed, when the oil—not being miscible with the water—rises to the surface or sinks to the bottom according to its density.

Mechanical processes are employed in the case of such oils as lime and lemon, in which the essential oil is present in the rind of the fruit. There are two or three variations of this process, the most common being the so-called "ecueille" process. An ecueille is a saucer-shaped vessel, usually made of tinned copper, fitted with a hollow stem, the inside of the saucer being covered with short spikes. The fruit is placed in the ecueille and, with a rapid circular motion, the oil cells are ruptured, the oil exuding and running down into the hollow stem.

Extraction processes involving solvents are employed principally for extracting the scent from flowers of delicate perfume, which would be impaired were the flowers to be subjected to steam distillation.

Two kinds of solvents may be employed; volatile, such as alcohol, benzene, ether or chloroform; and non-volatile, such as neutral animal fat.

In the case of volatile solvents, the extraction consists, as in the case of fixed oils, in allowing the solvent to percolate through the flowers. The solvent is distilled off and the residue utilised for the manufacture of so-called floral essences.

In the case of the non-volatile solvent, the fresh flowers are laid on trays covered with a thin layer of the neutral fat, and replaced until the fat has become saturated. The scented fat is then removed and sold as "pomades," which are employed in the manufacture of perfumes.

Application and Uses.—Essential oils are used principally as perfumes, flavourings for foods and drinks, and in medicine—in the last case either as specific drugs or as flavourings to render a medicine more palatable. It will be readily understood that, except for those of medicinal value, this class of oil is in reality a luxury and not, as in the case of the fixed oil, a necessity.

MAIN OIL-YIELDING CROPS.

It is considered that the two main oil-yielding crops best suited to the conditions prevailing in this country are coconuts and African oil palm. As regards coconuts, this crop is now the second in importance in the country, while the experimental work carried out up to date on the cultivation of the African oil palm indicates clearly that this particular crop is also capable of being developed on a plantation scale to meet the ever-increasing demand for oils and fats.

COCONUTS.

(*Cocos nucifera*).

The coconut is undoubtedly the palm of the greatest economic importance, being found distributed throughout the tropics.

Distribution.—As regards Malaya, there is no doubt that the climate is suited to the growth of coconuts, which thrive well throughout the whole Peninsula,

Coconut-Monkey Climbing Tree.

particularly in the coastal districts. Such land is generally flat, and is usually provided with natural outlets and sufficient fall to allow of thorough drainage. The soil is mostly alluvial, and palms grown under such conditions commence flowering in their third or fourth year. Coconuts are, however, cultivated in the inland districts, but there they take longer to reach the producing stage.

In Malaya, the principal areas in which this crop is to be found are: Penang; Province Wellesley; Krian; the Dindings; the Bagan Datoh district in Lower Perak; along the coast from the Bernam river to Sepang in Selangor; the coastal districts of Pahang, Johore and Kelantan.

Cultivation.—The most suitable soil for coconut cultivation is an alluvial loam, but some of the stiff clays, when properly drained, also produce excellent crops. When the area to be opened up is low-lying, as is common in the coastal districts, rentices are first made through the jungle and the main drains cut immediately, in order to dry the land as much as possible before felling is commenced.

The next operation is to lay down the nursery. Nuts for seed should be gathered from well-matured palms, between fifteen and forty years old, which are known to be good yielders. The nuts should be fully matured before being picked from the tree and allowed to dry for one to two months after they are picked, in order to harden the husk. Nursery beds, about four feet wide, should be carefully prepared with good soil, and slightly raised to permit efficient drainage. A thin layer of sand on the surface of the beds is beneficial as it prevents the ground from becoming too damp and causing

the roots to rot. When the beds are ready, the seed nuts should be partly buried in rows about two feet apart in an oblique position, with the acute end of the nut downwards. The seed beds are shaded for a time, but the shade should be gradually removed and the plant fully exposed before it is ready for planting in the field. The best age at which to remove seedlings from the nursery for transplanting in the field is from five to seven months. If left in the nursery longer, the difficulty of transplanting is greater and the roots are liable to get damaged.

AFTER felling and burning operations are finished, the land is thoroughly cleaned and prepared for planting. The best distance of planting in the field is 30 ft. x 30 ft. square, which gives 48 trees per acre. The area should be carefully lined and rolled ready for planting. The holes, which are usually made two feet wide and two feet deep, are filled up with good surface soil and the seedling planted so that the top of the nut, where it starts to germinate, is just above the level of the ground. Deep planting should be avoided.

THE most critical time for the palm is during the early stages of its life, that is, from time of planting to the third or fourth year; it is only by careful attention during this period that early maturing and good bearing palms are likely to result. After planting, the ground around the young palms should be clean weeded, and no grass or other weeds should be allowed to interfere with their growth. To develop the feeding roots, the surface soil at the base of the palm should be kept in a friable condition by digging or forking at least once every three or four months.

As an alternative to clean weeding, leguminous cover crops may be established in the first year of growth. These will reduce the cost of weeding and, at the same time, increase the fertility of the soil. When the young plants begin to develop, growth may be further improved by surface cultivation with ploughs or disc harrows. On peaty land, where the soil is apt to subside after it is opened up, mounding or banking the young plants is often necessary, and this operation may have to be continued until the land has settled down to its normal level. On low-lying land, drainage operations will have to be carried out, as the coconut palm will not thrive in a water-logged soil.

Pests and Diseases.—The coconut palm is fairly free from the attacks of insect pests and diseases. The worst pests are the red-stripe weevil (*Rhynchophorus schach, Oliv.*), the black beetle (*Oryctes rhinoceros, Linn.*), and the caterpillar of a moth *Artona* (*Brachartona*) *catoxantha, Hamps.*, whilst the chief diseases are sporadic cases of bud-rot and the leaf-spot caused by *Pestalozzia palmarum.*

Yields.—The coconut usually comes into bearing between the fourth and sixth year after planting, and may continue to bear good crops of fruit for sixty years or more. When the trees come into bearing, the ripe nuts are collected every two to two and half months, which gives five to six pickings during the year. A good palm in full bearing will yield as many as 80 to 100 nuts, but the average is about 50 nuts per palm per annum, or approximately 2,500 nuts per acre per annum.

Nuts for making copra should only be collected when fully ripe. After harvesting, the nuts should be allowed to remain unhusked for about two weeks;

the fibrous husk is then removed, and the nuts split open with a sharp knife. The kernel or meat is removed from the shell and dried in the sun, or in special kilns artificially heated. The latter method is both quicker and cleaner. The dried product is known as copra. Usually from 230 to 250 nuts are required to produce a picul* of copra, equivalent to about 4,000 nuts to a ton of copra.

The Dwarf Coconut.—The Dwarf or King coconut, which is known locally as "Nyiur Gading" has recently attracted considerable attention as a possible new enterprise. Only one estate has, so far, attempted its cultivation on a large scale, and it is still doubtful whether the results obtained will justify the returns which are anticipated, or even bear comparison with those of the commonly cultivated tall variety.

THE Dwarf variety is usually planted 22 ft. x 22 ft. square, giving 90 trees per acre, and comes into bearing at about the third year after planting. The average yield at six years is stated to be 80 nuts per palm per annum. The nut is smaller, and the kernel thinner, than that of the ordinary variety, with the result that, on the average, 500 nuts are required to produce a picul of copra.

THE chief advantages of the dwarf coconut are that it is hardy, matures early and is very prolific; but its main drawback is the small size of the fruit, which necessitates the handling of about twice the number of nuts per picul of copra as compared with the tall variety.

* 1 picul = 133$\frac{1}{3}$ lbs.

Extraction of Oil.—Copra is rich in oil, containing from 68 to 72 per cent. of oil, which, when extracted, is known as coconut oil. As the cake remaining after the extraction of the oil is a valuable ingredient of feeding stuffs, coconut oil is almost invariably obtained by the method of expression, the yield of oil obtained under these conditions being about 62 to 64 per cent. on the copra.

BEFORE being pressed the copra is treated in a special machine known as a disintegrator, which breaks it up into small pieces, after which it is passed through crushing rolls to reduce it to a fine state of division. Owing to its high oil content, the meal is heated and pressed twice. In some cases expellers are used for the first expression. The second expression is always carried out in a hydraulic press, preferably of the cage type.

Desiccated Coconut.—Although the attention of coconut plantations in this country is confined chiefly to the production of copra, a small industry has recently been started for the manufacture of desiccated coconut.

IN the manufacture of this product, the kernel is removed from the nut while quite fresh and, after the brown skin on the surface has been cut off, shredded and dried in hot-air ovens at a temperature of about 160° F. The dried product is then graded and packed in boxes for export.

Uses.—Coconut oil is without doubt the most economically important vegetable oil, and is used in enormous quantities throughout the world in the manufacture of substitute butters, such as margarine, other edible fats, soaps and candles. In addition, wherever the coconut palm is to be found,

large quantities of this oil are prepared locally by the natives for their own consumption, this being the favourite oil for general purposes such as cooking and, to a less extent, for toilet purposes and as an illuminant.

As stated above, the residue remaining after the expression of the oil forms a valuable feeding stuff for cattle. Desiccated coconut is used as a food-stuff, principally in confectionery.

In addition, coir ropes, mats, brooms and brushes may be made from the fibre obtained from the husk; but in Malaya, at present, the husk is either burnt as fuel for the copra kiln or returned to the soil to rot. The shells are also used as fuel for the drying kilns.

Alcohol can also be produced by fermenting the sap obtained by cutting periodically the unopened flower spathe of the palm and collecting the liquid which exudes. This liquid, when fermented, as is well-known, is the favourite beverage of the Tamil coolie.

Exports.—(a) *Copra.* The following table shows the exports of copra from the Straits Settlements for the period 1919 to 1921.

Year.	*Quantities.* Piculs.	*Value.* $ *
1919 ..	1,912,647	33,776,114
1920 ..	1,994,098	45,753,153
1921 ..	2,259,996	27,619,578

* $1 (Straits currency) = 2*s.* 4*d.*

THE above figures include, however, large quantities of copra imported into Singapore and Penang for re-export, in each case amounting to approximately half the total quantity exported.

THE principal countries to which exports of copra were made during the year 1921 were as follows:—

Countries.	*Quantities.*	*Value.*
	Piculs.	$
Netherland ..	737,547	8,809,591
Germany ..	529,769	6,590,893
France ..	358,600	4,401,679
United Kingdom	246,581	3,115,332
Spain ..	209,198	2,414,552
Denmark ..	106,022	1,325,530

(b) *Coconut Oil.* The production of coconut oil in Singapore and Penang, where there are a few mills engaged in this industry, is fairly considerable, the exports in 1921 being valued at $3,788,223 compared with $5,786.569 in 1920.

THE principal countries to which this oil is exported are Sumatra and Siam, whilst large quantities are consumed locally in the Malay States.

(c) *Coconuts.* In addition to the export trade in copra and coconut oil, small quantities of whole coconuts are exported from the country; the value of such nuts exported during 1921 was $373,850 against $463,650 in 1920.

General.—The cultivation of the coconut under suitable conditions can be safely expected to give steady, though small, returns; with good management, a profit of ten or even twenty per cent. on the capital outlay involved is possible with copra at about $12.00 per picul.

THE present market price of copra in Singapore (October, 1923) is quoted at $11.00 per picul, whilst the latest London quotations (September, 1923) for the various products are as follows:—

Copra (Straits)	..	£24 per ton.
Coconut oil	..	£38—£47 per ton.
Coconut oil cake	..	£ 7—£ 8 ,,
Coconut (desiccated)		37/- per cwt.

AFRICAN OIL PALM.

(*Elaeis Guineensis*).

THE African oil palm, the fruit of which yields the two well-known oils of commerce, palm oil and palm kernel oil, was introduced into the Netherlands Indies in 1848, but did not receive serious consideration as a plantation crop until the last decade.

DURING this period considerable progress has been made in the Dutch East Indies where, according to Rutgers, the area planted with oil palms on the east coast of Sumatra had increased from 8,500 acres in January, 1918, to 28,000 acres in January, 1922.

ATTENTION is also being given to the cultivation of this crop on a plantation scale in this country, the area planted to date being estimated at about 3,000 acres, of which 500 acres are in bearing. The export of palm oil and palm kernels has already commenced. Numerous applications for land have recently been made which shows that the possibilities of the crop are now being realised by the local planting community.

Varieties of Oil Palm.—Although different varieties of *Elaeis Guineensis* have been described, based primarily on the form and composition of fruit, it

is somewhat doubtful whether there are any definite fixed types, and breeding experiments will have to be carried out to determine this point.

THE "Deli" type, which is in general cultivation in Sumatra and this country, is considered to be most suitable to the local conditions, and it is doubtful whether it will be superseded by other varieties introduced from West Africa, where the palm is indigenous.

THE composition of the fruit may vary (a) in the percentage of pericarp and its oil content, (b) in the percentage of kernel and its oil content, (c) in the thickness of the shell enclosing the kernel. Improvement may be brought about by selection work on the existing varieties, the main objects being to produce a type with fruit giving (a) the maximum amount of pericarp with a high oil content, (b) a thin shell with the maximum amount of kernel of high oil content. In selecting parent trees, allowance will have to be made for alteration in type due to external environment, which may have a greater effect than genetic constitution.

Cultivation.—The general cultivation of the oil palm is similar to that already described for the coconut, and the conditions both as regards soil and climate appear to be much the same for both crops.

THE most suitable soil for the African oil palm is an alluvial loam over-lying a clay subsoil, which will permit of easy root penetration and retention of moisture. Light sandy soil or swampy land is unsuitable. Although it may be grown successfully on gently undulating land, the flat coastal land, provided it can be properly drained, is likely to give the best results.

THE oil palm is propagated from seed, the time taken for germination varying considerably, depending both on age and method of treatment in the propagating beds. Seeds imported from West Africa, which have dried up, or those which are either unripe or overripe, germinate very slowly; whilst even good ripe seeds obtained locally, when sown as fresh as possible, may by no means germinate rapidly. This is a serious drawback when a definite planting programme has been arranged and, therefore, special attention must be given to the method of propagation in order to accelerate germination as much possible.

THE most satisfactory method of germination is to collect only ripe seeds and, after removing the pericarp, to sow them at once, just below the surface, in specially prepared beds consisting of pure sand about 1 foot deep. The beds are exposed to the full sun and are kept moist by constant watering. Immediately the two leaf sheaths appear above the surface, the seedlings are removed from the sand beds and planted out about 1 to 1½ ft. apart in specially prepared nursery beds on good flat land. The seedlings remain in these beds until ready for transplanting into the field, which may be from 8 to 10 months according to the season when they were planted out in the nursery beds.

THE most suitable distance of planting in the field is 30 ft. x 30 ft. triangular (equilateral), which gives approximately 55 palms per acre. The area to be planted is lined and holed in the same way as that recommended for coconuts. The oil palm stands transplanting fairly well under ordinary conditions and, therefore, very little supplying should be necessary. After planting, the land should be either

African Oil Palm (Elaeis Guineensis).

Artificial Pollination of Oil Palm.

clean weeded, or a suitable leguminous cover crop established. In cases where planting is carried out on undulating land, steps should be taken to prevent soil wash, which is best done by (a) planting low-growing cover crops, (b) silt-pitting, or (c) terracing, all of which tend to arrest the erosion of the surface soil by diminishing the force of rain water which carries away the finer particles of the surface soil.

Although catch crops are not generally recommended, those of a temporary nature are sometimes cultivated in the early stages of development in order to provide a certain amount of revenue. On areas where the soil is suitable for the cultivation of coffee, Robusta or its hybrid varieties may be grown with a certain degree of success.

When the palms come into bearing, at the end of the 3rd. or 4th. year after planting out in the field, it will be necessary to commence a regular system of pruning the leaves at the base of the palm. The leaves immediately below the growing bunches of fruit should not be removed until the fruit is almost ripe and ready for harvesting. The pruning operation should be carefully carried out, since the total fruit production of heavily pruned trees decreases very rapidly when compared with those pruned normally. Pruning is now practically restricted to cutting off those leaves which have a ripe bunch in their axils.

Pollination.—Observations on young or isolated palms have shown that natural pollination does not always take place, which has led to experiments

being conducted on artificial pollination. The male and female inflorescences are produced on the same palm but not necessarily at the same time and, as the flowers on the female inflorescences remain in a receptive condition for a period of only two days after the opening of the flowers, it is frequently necessary to obtain pollen from a male inflorescence on another palm, otherwise the flowers may not be fertilised.

WHERE artificial pollination is necessary, a ripe male inflorescence, denoted by its strong smell of aniseed, is selected; after careful removal from the palm, it is held over a specially made funnel and shaken so that the pollen grains fall into a suitable receptacle placed under the funnel. The pollen should be collected in the afternoon and, the following morning, is dusted on to the female inflorescences ready for pollination.

WHILE artificial pollination may be advisable in the case of young palms, it may be found unnecessary in the case of older ones, which may be sufficiently pollinated by natural agencies. Experiments in artificial pollination have shown that it can be overdone, but it remains to be determined to what extent it can be carried out successfully in actual practice over a continuous period. In some cases, more particularly on poor land, over-pollination by artificial methods has resulted both in the reduction of the size of the fruit and the percentage of pericarp.

Pests and Diseases.—So far, the oil palm does not appear to have suffered greatly from the attacks of insect pests or fungoid diseases; but, with an

increased area under cultivation on a plantation scale, quite different conditions would prevail, the risk of both pests and diseases naturally becoming greater.

AMONG insect pests, the coconut beetle (*Oryctes rhinoceros, Linn.*) and the red-stripe weevil (*Ryhnchophorus schach, Oliv.*) have been found doing damage, the latter having been known to kill palms by boring through the main stem.

THE only disease so far reported, which appears to be confined to young palms, is the "crown disease." This is a weakening of the leaf stalk of the young leaves, which become bent and fall over, giving the crown a twisted appearance. As a rule, after some time, new leaves are formed and the palm recovers its normal appearance.

OTHER pests which may be mentioned are rats, pigs, and porcupines, which must be exterminated by the usual methods, such as poisoning, trapping or killing in some other way.

Harvesting.—As previously stated, the palms come into bearing at about the 3rd. or 4th. year after planting, and the fruit ripens about 6 months after pollination. The crop is not evenly distributed over the different months of the year, the maximum crop being obtained in the dry season and the minimum in the wet season; the maximum production per month is about double the average monthly production.

THE fruit bunches should be gathered systematically as soon as they are ripe, and carried to collecting sheds. Here they are stored on open racks for three of four days until the fruits fall from the bunch on to the trays below. The loose fruit is then collected and transported to the factory, where the oil is to be extracted. Great care is necessary in the handling of the fresh fruit; in no circumstances should it be allowed to remain in heaps, otherwise it will ferment, resulting in a large increase in the acidity of the oil.

Composition of Fruit.—The following table shows approximately the average composition of the fruit grown locally:—

- FRUIT
  - Pericarp 58 per cent. ... ...
    - Moisture 33 per cent.
    - Palm Oil 53 ,,
    - Residue 14 ,,
  - Nut 42 ,,
    - Shell 85 per cent.
    - Kernel 15 ,,
      - Moisture 15 per cent.
      - Palm K. Oil 43 ,,
      - Residue 42 ,,

Proportion of Palm oil on whole fruit = 31 per cent.
,, ,, Kernel oil on ,, ,, = 7 ,, ,,

Yields.—Individual palms may produce from 6 to 10 bunches per annum, whilst the weight of picked fruit may vary from 75 to 150 lbs. per palm per annum according to age. With palms planted 55 to the acre, a fair estimate of the annual production would be 1,250 lbs. of palm oil and 330 lbs. of kernels per acre in the sixth year, increasing to 2,400 lbs. of palm oil and 650 lbs. of kernels per acre in full bearing.

Extraction of Oil.—The African oil palm fruit contains two distinct oils, namely palm oil, present in the flesh or pericarp, and palm kernel oil, contained in the kernel. As previously stated, the treatment

of these fruits calls for special attention as there is present in the pericarp an active fat-splitting enzyme or non-organised ferment; it is of the utmost importance that the fruit be picked when ripe and treated while still fresh, otherwise a large part of the oil will be decomposed, with the formation of an abnormal proportion of free fatty acids. With care, this acidity can be kept below 5 per cent.; but, if the fruit be allowed to lie about, and the oil extracted in the primitive native method by boiling out with water, it may contain up to 50 per cent. of free fatty acids.

THE method usually adopted to obtain palm oil of high quality consists in a preliminary heating of the fruit to destroy the ferment, and subsequent pressing while still hot, in order to obtain as much of the oil as possible without cracking the nut. The pericarp is then stripped from the nuts in a special machine known as a depulper or depericarper and, after drying, is pressed again to obtain the remainder of the oil. The residue is used as fuel, having no value as a feeding stuff or fertiliser.

MENTION might also be made of a modification in this method involving the use of a centrifugal extractor. In this modified process, the fruits are steamed and depericarped without any preliminary pressing, after which the mass is charged into the extractor, in which is removed the greater portion of the oil and moisture. The centrifugal action also facilitates the separation of the nuts from the fibrous residue, which is then pressed again as described in the previous process.

THE oil is then allowed to settle, and is strained into casks ready for export. Care must be taken in the selection of the wood for the casks, oak staves

being preferable in order to minimise the loss arising through leakage. Casks of standard size are employed, 10 tons of oil requiring about 15 casks.

AFTER separation from the fibre, the nuts are dried and then cracked by a nut-cracking machine, the kernels being separated from the shells by flotation in brine or clay suspended in water. The kernels are then dried for export, the shells being used as fuel.

THE expression of the oil from the kernels is carried out in a similar way to that already described for copra, the kernels being ground and hot-pressed twice in order to obtain the maximum yield of oil. The residue known as palm kernel cake is used as a feeding stuff.

Uses.—Palm oil finds a varied application in industry according to its free fatty acid content. While an oil of medium quality is largely employed in the manufacture of soaps, lubricating greases and candles, an oil with a minimum quantity of free fatty acids, from 2 to 4 per cent., can be used for edible fats. Hitherto, the quantity of such high grade palm oil available has been limited; but, with regular supplies coming forward, it should be able to compete as an edible fat with either coconut or palm kernel oil, since it has been proved that high quality palm oil forms an excellent basis for the preparation of substitute butters.

AS stated above, palm kernel oil is used chiefly in the manufacture of edible fats, smaller quantities being employed in the soap making industry. Palm kernel cake is used as an ingredient of many feeding stuffs.

General.—From actual experience gained in the cultivation of the African oil palm in this country, it appears that it is a crop which is well worth developing on a plantation scale. The yields recorded locally are sufficiently promising to warrant the outlay of further capital for the development of this industry, and it is considered that the return on the capital invested will be at least equal to, if not greater than, that obtained from the cultivation of coconuts.

THE present London quotations (Sept. 1923) for African oil palm products are as follows:—

Palm oil (Lagos)	..	£32.10 per ton. *
Palm kernels	..	£16.10 ,, ,,
Palm kernel oil	..	£35.10 ,, ,,

MISCELLANEOUS OIL-YIELDING CROPS.

IN addition to the two main oil-yielding crops just described, there are several other oil-yielding plants which may be cultivated successfully in this country. Their cultivation, however, is never likely to be developed to such an extent as to cause them to be regarded as main crops, either because they are not suited to large scale plantation conditions or because the oil has only a limited industrial application. It is considered advisable to describe the cultivation of some of these plants as, in many cases, it will be seen that they are suitable for the smallholder.

* This figure does not apply to palm oil with a low free fatty acid content, for which a varying premium is paid.

FIXED OILS.

Groundnuts. (*Arachis hypogaea*).—This is an annual herbaceous plant the seeds of which yield, when expressed, the well-known groundnut or peanut oil of commerce. It is a plant which is cultivated extensively throughout the tropics, and one particularly suited to the requirements of a small holder.

THERE are a large number of varieties known to cultivation, the most common being the so called Mauritius, Senegal and Spanish types.

Cultivation.—The plant thrives best on sandy or loamy soils, heavy or stiff clays being unsuitable owing to the difficulty with which the pod stems penetrate the soil. It is essential that the land be clean and free from weeds before planting. The soil should be either changkolled or forked to a depth of about 6 inches and then made up into ridges from 1½ to 2 ft. apart. The shelled seed is then sown about 2 inches deep and 15 to 18 inches apart on the ridges. The best time for sowing is at the beginning of a rainy season. During the period of growth little cultivation beyond weeding is necessary.

Harvesting.—The crop matures in about 3 to 5 months according to the variety of the seed and the nature of the soil. When the stalks and leaves of the plant begin to wither, and the skin on the kernel has turned pink, the crop is ready for harvesting. After collection, the nuts should be throughly dried in the sun before being stored.

THE plant is rich in nitrogen, so that after the harvest the stalks and leaves should be ploughed in as a green manure.

Yields.—The yield varies considerably and may be from 1,000 to 2,000 lbs. of nuts per acre according to the conditions of soil and season.

Extraction of Oil.—The kernels contain from 43 to 48 per cent. of oil, which is largely used as an edible oil. For edible purposes, the oil is obtained by cold pressing, that obtained by subsequent hot pressing being used chiefly for soaps. The cake remaining after the expression of the oil forms a valuable feeding stuff, being rich in albuminoids.

THE approximate prices (Sept. 1923) are as follows: Groundnuts (undecorticated) £17.10 per ton, Groundnut oil £43 to £46 per ton and Groundnut cake £8 to £10 per ton.

Gingelly. (*Sesamum indicum*).—This is an annual herbaceous plant from 2 to 4 ft. high indigenous to Southern India and tropical Africa. There is a number of varieties, with differences in the colour of the seed, the most common being the black and the white.

Cultivation.—The plant can be cultivated successfully on moderately good soil providing this is well drained and has been brought to a fine tilth. The seed is sown broadcast, and is usually mixed with sand in order to facilitate even distribution. The crop is ready for harvesting in from 3 to 4 months, according to the variety. The time for sowing should be so arranged that the crop will mature in a dry period.

Harvesting.—When mature, the plants are cut off close to the ground, tied up in bundles and left to dry in a sheltered place. After a few days the

capsules burst and the seeds can be removed readily by beating out the heads. If the plants are allowed to become overripe before harvesting, the capsules will burst in the field with loss of seed.

Yields.—The yield is somewhat variable, from 500 to 800 lbs. per acre being considered a fair average under ordinary conditions.

Extraction of Oil.—The seed contains from 45 to 55 per cent. of oil, which is used largely for edible and medicinal purposes. The best quality oil is obtained by cold pressing, that obtained by hot pressing being used chiefly in soap making. The residue is used either as a feeding stuff or fertiliser.

THE current price (Sept. 1923) for Gingelly seed is £22 per ton.

Castor Oil. (*Ricinus communis*).—This is a tall growing shrub, the seeds of which are used for the preparation of the castor oil of commerce. There are numerous varieties, showing considerable differences both in the colour and size of the seed. It is a somewhat exhausting crop and requires a fairly rich soil, preferably low-lying alluvial flats. The plants begin to produce seed about 4 to 5 months from sowing, the harvest continuing for a few months dependent on both variety and season. The yield is very variable and a crop of from 500 to 1,000 lbs. of seed per acre may be obtained.

THE seeds contain from 45 to 50 per cent. of oil which is put to a variety of uses, being employed in the manufacture of soaps and lubricants, the dyeing and leather industries. In addition, castor oil is well-known for its medicinal properties, for

which purpose the oil should always be obtained by cold pressing. The cake remaining after the expression of the oil is poisonous and can therefore only be used as a fertiliser.

THE present prices (Sept. 1923) are as follows: Castor seed £19 per ton, Castor oil £49—£53 per ton.

Candlenut. (*Aleurites triloba syn. A. moluccana*). This is a tall-growing tree attaining a height of from 40 to 50 ft. The fruits contain hard-shelled nuts, the kernels of which have an oil content of about 62 per cent., equivalent to about 19 per cent. on the nut.

THE oil, which is obtained by expression, is a drying oil, somewhat inferior to linseed, and can therefore be used for more or less the same purposes, such as paints, varnishes and soft soaps.

THIS crop has so far only been cultivated in this country on an experimental scale and few details as to its possibilities are available.

Rubber. (*Hevea Brasiliensis*).—This tree is too well-known to require description. The seed kernels contain about 42 per cent. of oil, equivalent to about 24 per cent. on the whole seed. Like candlenut, this oil belongs to the drying class, being also inferior to linseed oil. The seed contains an active fat-splitting enzyme or non-organised ferment and, to obtain a high grade oil, the seeds should be pressed either as soon as possible after collection or treated in some way to prevent the development of this free fatty acid. It might be mentioned that seed is only obtainable during about 3 months of the year. The oil cake appears to have considerable possibilities as a cattle food.

Kapok. (*Eriodendron anfractuosum*).—A moderate sized quick-growing tree, primarily cultivated for the fibre known as kapok. The seed contains about 20 per cent. of oil which is used to a certain extent, especially in Holland, for edible and soap making purposes. It is not a well-known oil, but it can be used for the same purposes as cotton seed oil; the cake, also, is a valuable feeding stuff. There is reason to expect that, with regular shipments of seed coming forward, the market for this oil will extend considerably.

Cotton. (*Gossypium spp.*).—Cotton seed is one of the most important of the world's oil-bearing seeds, in the same way as cotton is the most important of all known fibre plants. The seed contains about 20 per cent. of oil which, when refined, is used to an enormous extent in the preparation of substitute butters and edible fats, while the lower grades are employed in soap making and for a variety of other purposes. Cotton seed cake is one of the most common feeding stuffs, being particularly suitable for cattle.

So far, cotton has only been grown on a small experimental scale in this country.

The current prices (Sept. 1923) are as follows: Cotton seed £9 to £11 per ton, Cotton seed oil £37 per ton.

Illipe. The so-called Illipe nuts, which are a forest product largely imported into Singapore from Borneo, Sumatra and other small islands of the Malayan Archipelago, are obtained from the fruits of various species of plants, among them being species of *Shorea* and *Isoptera* (N. O. Dipterocarpeae) and a species of *Palaquium* (N. O.

Sapotaceae). The fat content of the nuts shows considerable variation and may be from 40 to 60 per cent. The principal interest of the fat, which is known as Borneo tallow, is that, on account of its hardness, it is specially suitable for the manufacture of hard edible fats, being used in the preparation of chocolate. The fat from the *Palaquium* species, the nuts of which are known in the trade as Siak nuts, is used only for soap making.

Croton (*Croton Tiglium*).—This is a small tree or shrub, from the seeds of which croton oil is obtained. The seeds contain about 55 per cent. of oil, which has only a very limited market. It is employed chiefly in pharmacy.

THE present price (Sept. 1923) of Croton seed is about 30*s*. per cwt.

Cashew Nut. (*Anacardium occidentale*).—A spreading tree about 30 to 40 ft. high, bearing seeds, the kernels of which are edible, being used as a dessert nut and in the manufacture of sweetmeats. These kernels contain between 40 and 45 per cent. of oil, which, it has been suggested, might be utilised in pharmaceutical preparations in a similar way to almond oil.

Nutmeg. (*Myristica fragrans*).—The seeds of this tree yield about 40 per cent. of fat, yellow in colour, soft in consistency, and with a strong nutmeg flavour. This so called nutmeg butter is used to a very limited extent in the preparation of various medicinal ointments.

Roselle. (*Hibiscus sabdariffa* var. *altissima*). The seeds from this plant, which is cultivated primarily for its fibre, contain about 17

per cent. of an oil, which is similar to both kapok and cotton seed oils and could doubtless be used for the same purposes.

Chaulmoogra. (*Taraktogenos kurzii*).—The seeds from this tree yield chaulmoogra oil, which has been much used in the past for treating skin diseases and is now being employed as a cure for leprosy.

Native Oils. In addition to the foregoing, there are to be found, used by the natives in various parts of the country, other fixed oils amongst which might be mentioned "Buah Prah" (*Elateriospermum Tapos*), Kapayang (*Pangium edule*), and Calophyllum oil (*Calophyllum Inophyllum*).

As these trees are generally so scattered, and the quantities of the various oils available so small, they are not likely to be of any economic importance.

ESSENTIAL OILS.

Citronella. (*Cymbopogon Nardus*).—A coarse grass, 3 to 4 ft. high, largely cultivated for the production of the essential oil which it contains. The grass can be propagated readily from root divisions, which are planted in rows 2½ to 3 ft. apart, and the first cutting of grass can be made at about 8 months from the time of planting, after which it can be cut twice a year. Cuttings may be continued for a period of 8 to 10 years, when the grass must be replanted. A yield of about 5 tons of fresh grass per acre is obtained at each cutting.

THE extraction of the oil is carried out by the steam distillation method. After cutting, the grass is allowed to dry for a few days before distillation in order to save fuel, and therefore the harvest should be arranged to take place during a dry spell. The yield of oil is highest with young grass, when it may be as high as 0.8 per cent., while with old grass it may be as low as 0.3 per cent. On a basis of two cuttings a year and an average oil content of 0.5 per cent., the yield of oil is about 110 lbs. per acre per annum.

THERE is a steady demand for this oil, which is largely used for scenting soaps and for the manufacture of various artificial perfumes. The oil from this country, which is slightly superior to that produced in Ceylon, at present realises about 4*s*. 3*d*. per lb. (Sept. 1923).

Lemon Grass. (*Cymbopogon citratus*).—This grass is somewhat similar to citronella in appearance, although not so strong in growth. It is propagated in the same way but is planted rather more closely, usually 2 to 2½ ft. apart. The grass is ready for cutting when about 8 months old, after which two cuttings a year can be maintained for some years. The yield of fresh grass usually obtained at each cutting is about 4 tons per acre. The extraction of the oil is carried out in the same way as that described for citronella. The yield of oil is much less, being only between 0.2 and 0.3 per cent., calculated on the fresh grass, which is equivalent to about 45 lbs. per acre per annum.

At present, there is little demand for this oil, which is used in the preparation of artificial perfume. The current price (Sept. 1923) of the oil is about $2\frac{3}{4}d.$ per ounce.

Patchouli. (*Pogostemon spp.*).—Patchouli is an herbaceous plant, about 2 to 3 ft. high, cultivated for the essential oil contained in the leaves. The plant is propagated by stem cuttings planted in carefully shaded nursery beds; when rooted, these are transplanted in the open at distances of 2 to 2½ ft. apart. The first crop of leaves may be made about 6 months after planting out in the field, and subsequent pickings may be made twice a year. It is customary to replant about every two years.

The leaves, after cutting, must be dried in the shade, care being taken to ensure that they do not become mouldy during the process. When dried, they may be either packed in bales for export, or steam distilled according to the method already described.

It is stated that the dry leaves yield by distillation between 2 and 4 per cent. of oil, which is used entirely as a perfume.

The present price (Sept. 1923) of the oil is about 28*s.* per lb.

Vetiver. (*Vetiveria Zizanioides*).—A perennial grass, about 4 ft. high, which yields from its roots by steam distillation the vetiver oil of commerce. The leaves of the grass are without odour. The grass is propagated by root cuttings similar to citronella, and planted in rows 2½ to 3 ft. apart. The plants are ready for lifting after 9 to 12 months. The roots are washed to remove adhering soil and dried in the sun. To obtain the

oil the dried roots are steam distilled. The oil is very viscous and the distillation is therefore lengthy. The yield of oil is about 0.5 per cent. calculated on the fresh air-dried root.

VETIVER oil is used exclusively in perfumery on account of its fixing properties, since it prevents other essential oils from volatilising too rapidly. The present market price (Sept. 1923) of the oil is about 21*s*. per lb.

Limes. (*Citrus acida*).—A small spiny tree producing the well-known lime fruits which, in addition to being used as fruits, are also employed for the manufacture of concentrated lime juice and citric acid.

DURING the process, the essential oil contained in the rind of the fruit is recovered, partly as an expressed oil and partly as a distilled oil. The expressed oil is obtained by treating the fruits in an ecueille as previously described, while the distilled oil is recovered when the first concentration of the raw juice, obtained by crushing the fresh fruits, is carried out.

OIL of limes is used in perfumery, as a flavouring for essences and confectionery, and in the preparation of scented soaps.

THE present market prices (Sept. 1923) of the oils are: Expressed 7*s*. 6*d*. per lb., Distilled 3*s*. 6*d*. per lb.

Cloves. (*Eugenia caryophyllata*).—A small conical tree yielding the cloves of commerce, which are the dried unopened flower buds. It is only, however, the inferior grades of cloves which are used for the production of the oil.

THE cloves are steam distilled to obtain the essential oil, the yield being from 15 to 18 per cent.

OIL of cloves is used principally as a flavouring, but also to some extent in medicine and microscopy.

THE present price (Sept. 1923) of the oil is about 7*s*. 6*d*. per lb.

Nutmeg. (*Myristica fragrans*).—This is a bushy tree about 30 ft. high, which is cultivated for the nutmeg and mace of commerce.

THERE is a small demand for the essential oil, which is obtained by steam distillation of the crushed nutmegs, the yield of oil being from 8 to 10 per cent.

NUTMEG oil is used almost entirely as a flavouring agent.

THE current price (Sept. 1923) of the oil is about 4*s*. 6*d*. per lb.

CONCLUSIONS.

ALTHOUGH it will be seen from the foregoing information that there is a large number of oil-yielding plants which can be cultivated in this country, yet the development of many of them on anything but a small scale is not possible.

IN the first place, there is only a limited demand for many of these oils, and any considerable increase in production would result in an overloading of the market, with a corresponding reduction in price. In the second place, many of these crops need a surplus of labour in the country, available at any time for the limited periods of planting and harvesting. This surplus is unfortunately not available in Malaya.

WITH crops such as coconuts and African oil palm, which produce more or less continuously throughout the year, these difficulties are obviated, as there is a steady demand for the products and a permanant labour force can be kept employed.

MALAYAN SERIES No. VII.

FIBRES.

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and on

RUBBER LATEX PAPER.

FIBRES.

SISAL HEMP.

MAURITIUS HEMP.

BOWSTRING HEMP.

MANILA HEMP.

ROSELLE FIBRE.

KAPOK (KABU KABU).

COTTON.

SINGAPORE:

Fraser and Neave, Limited, Printers.

1923.

Kapok Tree (Eriodendron anfractuosum), in Full Bearing.

Fibres.

THE fibres of commerce are classified usually as hard or soft according to their texture and uses, their application depending partly on their texture and also on other qualities, principally capacity for spinning.

ONLY about twelve of the large number of known fibres in the world have been utilised commercially.

FLAX has been in use for centuries, while hemp (*Cannabis sativa*) was utilised later, but long before some of the tropical fibres now in use.

THE principal hard fibres of commerce, which are derived entirely from plants, are Manila, Sisal, Mauritius, Bowstring and New Zealand hemp. These fibres are used almost entirely in the manufacture of cordage, i.e. ropes, twine, etc. The increasing use of mechanical harvesters for the harvesting of cereal crops has absorbed a large quantity of the hard fibres in the form of binder twine.

AT the present time the world's consumption of hard fibres is over 350,000 tons.

THE following figures for the year 1915 are of interest and show the principal countries of origin of the chief hard fibres:—

		Tons.
Philippines	Manila Hemp or Abaca (*Musa textilis*)	140,000
Java	Manila Hemp ..	600
Mexico	Henequen (*Agave fourcroydes*)	135,000
Cuba	„ (*Agave fourcroydes*)	3,000
Java	Sisal (*Agave rigida* var. *cantula*)	6,500
Bahamas	„ (*Agave rigida* var. *sisalana*)	4,300
B. E. Africa	„ (*Agave rigida* var. *sisalana*)	3,750
Hawaii	„ (*Agave rigida* var. *sisalana*)	1,000
Portuguese E. Africa	„ (*Agave rigida* var. *sisalana*)	600
New Zealand	New Zealand Hemp (*Phormium tenox*)	23,225
	Total ..	317,975

IN 1913 German East Africa exported 20,000 tons of Sisal hemp.

IN Mauritius and a few other countries, Mauritius hemp (*Furcraea gigantea*) is cultivated on a small scale, but is said to be less suitable than Sisal, also the percentage of fibre in the leaves is lower than in the case of Sisal.

BOWSTRING hemp (*Sansevieria spp.*) is at present a jungle product, but appears to offer possibilities as a subsidiary crop on old rubber estates.

THE soft fibres, which are used in the manufacture of textiles of different quality, include flax, jute, hemp, cotton, kapok, silk and wool, of which the first five are derived from plants.

ROSELLE fibre, which closely resembles jute, is discussed in this article, since a serious attempt is being made to establish the cultivation of this fibre plant in Malaya. At present it is not one of the commercial fibres of the world, and its market value and possibilities have not yet been established.

DURING the war period the price of fibres rose enormously but at the present time there is considerable fluctuation and prices have decreased.

THE experimental cultivation of Sisal and Mauritius hemp has been carried out for several years by the Department of Agriculture, but no yields have been recorded. Samples of Mauritius hemp have been reported on favourably and a specimen of Bowstring hemp prepared at the Department of Agriculture has been valued recently at £40 per ton, while samples of Foselle fibre have been valued at £20 per ton for uncombed, and £30 per ton for combed fibre.

MANILA hemp, Sisal hemp and Mauritius hemp can all be grown in Malaya and appear promising, although no definite information is available as to the probable profits.

IN the marketing of fibres, considerable care and attention has to be paid to grading and baling. In the case of Manila hemp there are about ten grades

on the market; and in the Philippines, from which the greater part of Manila hemp is derived, a Government grading staff exists for this purpose. The establishment of such a staff would only be justified if large areas were grown.

SISAL and Mauritius hemp can be prepared by retting, but the fibre is usually extracted in special decorticating machines, since the decorticated fibre is said to be stronger and better. Consequently it is necessary to establish large plantations, in order to run a factory economically. Since the proportion of fibre in the leaves is only three to four per cent., it is not economical to transport the leaves for a long distance to central factories. Manila hemp and Roselle fibre are prepared by hand, and small areas can be cultivated economically.

FIBRE machinery can be purchased from the following firms:—

Messrs. Marshall & Co., Gainsborough, England.

Messrs. Robey & Co., Ltd., Lincoln, England.

David Bridge & Co., Castleton Iron Works, Castleton, Lancashire, England.

Ernest Lehmann, 8, Chatham Buildings, Chatham Street, Manchester, England.

Prieto Machine Co., Inc., 45, Broadway, New York, U.S.A.

A complete plant for fibre extraction consists of a decorticating machine, crushing rolls for thick and hard leaves, a brushing machine and a baling press, with necessary prime mover in the form of a steam, oil or gas engine or motor, shafting, belting etc., and a building of a suitable size.

A decorticator can produce about 400 to 500 tons of fibre per year, representing leaves from 400 to 500 acres, and one machine is sufficient for 1,500 acres in the case of Sisal.

FIBRES for export must be baled under pressure to save excessive freight charges. A suitable weight for bales of fibre is about 2 cwt., and the fibre should be pressed so that a ton occupies 70 cubic ft.

DETAILS of cost of factories for the extraction and baling of fibre can be obtained from the Department of Agriculture, F.M.S. and S.S.

SISAL HEMP.

(*Agave rigida* var. *sisalana*).

THERE is a large number of varieties of Agave (Sisal), but only three are in general use, viz., *Agave rigida* var. *elongata* (Mexican Sisal), *Agave rigida* var. *sisalana*, and *Agave cantula*. The last named is said to stand a higher rainfall, hence its success in Java.

THE sisal plant is propagated from the small plants known as "bulbils" that arise in the axils of the flower-stalks or from suckers from the rhizome; the latter source is recommended.

Nurseries. The bulbils or suckers are planted in nurseries, which should be tilled to a depth of about one foot, the beds being about four feet wide, with one foot paths between. The bulbils or suckers are spaced nine inches apart in the nursery beds. Shading is unnecessary and watering seldom required; weeding, however, is important. The plants are generally kept in the nurseries for about one year. Suckers may also be detached from

the parent and planted direct in their permanent quarters. Bulbils can be supplied by the Department of Agriculture from time to time at a cost of one cent each; approximately 900 are required per acre.

Planting and Cultivation. The most suitable soil is a fairly dry, permeable, sandy loam, containing a small amount of lime. Good drainage is essential as the roots of the plants are liable to be damaged by standing water. On poor soils, the plants make inferior growth, but are said to contain a larger proportion of fibre than plants grown on too rich land. Hilly land is well suited for sisal cultivation as it allows of easy drainage. It is not necessary to break up the land, but all undergrowth must be removed. Holes, one foot deep, are made in rows eight feet apart, six feet apart in the rows, which allows about 900 plants to the acre. Planting should be undertaken during the rainy season, all fibrous roots and lower leaves having been first removed to facilitate new growth.

SYSTEMATIC weeding is necessary throughout the period the crop occupies the land. Light tillage to a depth of three or four inches is recommended when the clearing is about one year old; subsequent tillage is unnecessary.

Harvesting. The period before harvesting varies; but, in general, cutting commences within three years of planting out, or about four years from the planting of the bulbils in the nursery. The leaves, when ready for cutting, are removed close to the trunk, care being taken not to injure the younger leaves of the plant. The number of leaves which can be cut per annum varies consider-

ably; in Mexico twenty-five is the average, whilst in East Africa double that number is obtained. The estimated yield under good conditions is from 1,000 to 1,200 lbs. of dry fibre per acre; one ton of raw leaf will produce between 60 and 80 lbs. of dry fibre.

THE duration of life of the plant is determined by the production of the pole or inflorescence, the average length of life in Malaya being about eight years. This is a much shorter period than is the case in Mexico and is chiefly due to the local climatic conditions. It is stated, however, that this is no disadvantage as the same total crop is produced in a relatively shorter time.

IN view of the fact that the raw leaf only produces from three to four per cent. of dry fibre, the cost of transport to a central factory would be prohibitive; it is therefore necessary to install machinery in the locality of the plantation. At least 1,000 acres should be planted to warrant the erection of a factory installation of the necessary machinery for the production of first quality fibre.

Preparation of Fibre. The leaves should be treated in special decorticating machines within 24 hours of cutting. A woman is said to be able to cut 600 leaves per day and a man 800.

A "Corona" decorticator is said to treat 100,000 to 150,000 leaves per day producing two to two and a half tons of fibre per 8-10 hours' day. The decorticated fibre is hung on poles to dry in the sun for two days, and is brushed in special brushing machines to remove any extraneous matter, pulp etc. A constant supply of good water is essential

for the factory. Sisal hemp fibre can be prepared also by retting by hand labour, but the fibre is said to be weaker than, and of inferior colour to fibre prepared by decorticating machinery.

A labour force of one coolie per two acres is said to be required, and a European Manager can supervise a large area comprising about 5,000 acres.

SISAL hemp is quoted at £36 per ton, August, 1923.

Agave cantula. The Henequin of Yucatan, *Agave rigida* var. *elongata;* the Sisal of Hawaii, *Agave rigida* var. *sisalana;* and the Maguey of the Philippine Islands, recently identified at the Royal Botanic Gardens, Kew, as *Agave cantula*, are very similar plants. All have the short, thick stem, the aloe-like cluster of large, fleshy leaves, and the tall flower-stalk or "pole," which bears a large number of small "bulbils," or pole plants. The Hawaiian plant differs from that of Yucatan in having a shorter trunk, leaves smooth-edged, or bearing a few unequal teeth, and the fibre less in quantity but superior in quality. *Agave cantula* is said to be variety cultivated in Java and prepared by retting.

MAURITIUS HEMP.

(*Furcraea gigantea*).

MAURITIUS Hemp is very similar in habit of growth to Sisal Hemp; in cultivation it is also very similar, except that the former is planted a little wider apart, say eight feet by eight feet. The method of preparation of this fibre is similar to that of Sisal. THE quality of Mauritius hemp is not so good as that of Sisal and therefore it has a lower market value.

It can be propagated only by "bulbils," since no suckers are produced.

Recent experiments carried out at the Department of Agriculture to determine the percentage of fibre produced from freshly cut green leaves of various varieties of hemps have yielded the following results:—

	Dressed fibre. per cent.	Total fibre. per cent.
Furcraea gigantea (old plants)	1.82	2.24
,, ,, (young plants)	2.74	3.28
Agave rigida var. *sisalana*	3.79	4.49

The fibre was extracted in each case after the leaves had been retted for eighteen days.

These results show that Sisal produces a larger percentage of fibre than Mauritius, also that the young Mauritius produces a higher percentage than the old, indicating that it is unprofitable to allow Mauritius to become too old before cutting.

The higher percentage of fibre produced by Sisal as compared with Mauritius, together with the fact that the former commands a higher price in the market, points to the advisability of growing Sisal.

It must, however, be noted that Mauritius produces a heavier crop of leaves per acre, and the question which remains to be decided is, which class of fibre is the more profitable under Malayan conditions? This will depend on which makes the better growth in any locality, due allowance being made for the heavier charges for handling the Mauritius.

BOWSTRING HEMP.

THE herbaceous plant Bowstring Hemp has succulent leaves, blotched with gray and attaining a height of from two to three and a half feet or more. This plant yields fine, white, tough and elastic fibre. It is commonly found as an ornamental plant in gardens, and is well distributed throughout Malaya. It is indigenous to India and Ceylon, and is to be found growing in a large variety of soils, but thrives best in those which are fairly friable, and under partial shade throughout its period of growth; it appears to do well under the shade of old rubber.

THE plant is propagated by seed, division, or leaf cuttings, the latter being more convenient. The distance of planting is about two feet apart each way. The yield is reported to be one and a half tons per acre, as a sole crop.

THERE are many species of *Sansevieria*, the leaves of which yield a fibre suitable for cordage manufacture, found in most tropical countries. There are two very common types to be found locally. These plants have large, thick, underground stems or rhizomes which throw out numerous branches. The leaves arise from the base of the plant and vary in length. They are of a succulent nature, generally flat and wide, but some are thick and narrow.

A sample of fibre prepared from locally grown plants was forwarded to London and reported on as follows:—

"A hard, clean fibre; strength, good; height, fair; colour, dull white; preparation, good; texture, fine; value £40 per ton. (7—10—21)."

It was pointed out that small quantities would be more difficult to sell than larger quantities, as manufacturers would not care to touch it, unless they could get supplies on a fairly large scale, say 1,000 tons.

Fibre is extracted from the leaves by methods similar to those employed in the preparation of Sisal Hemp. The material is usually shipped in bales of four to five cwt.

The chief objection to this plant is that it is an extremely slow grower; on this account it is doubtful if it would pay to grow it commercially.

MANILA HEMP.

(*Musa textilis*).

Manila Hemp is derived from the sheathing leaf-stalks of *Musa textilis*. The plant requires a loose, moist soil, rich in humus and well drained, and appears generally well suited to Malayan conditions; it will not thrive on swampy land, or land liable to damage by surface wash. Manila Hemp is propagated by means either of root cuttings, or more commonly from the suckers which arise at the base of the parent plant; but sometimes it is grown from seed, the latter taking longer to reach maturity. Seed must be collected from fruits which have not become over-ripe.

Planting. Plantations are usually established by means of suckers planted out when about three feet high and spaced 8 to 9 feet apart. Holes are made 2 feet each way and left exposed to the influence of the atmosphere for a time. Previous to planting, the holes are filled in with the rich surrounding soil.

Cultivation. Subsequent tillage, beyond weeding, is unnecessary. The estate must always be kept free from lalang. Manila Hemp responds well to the application of potash and lime, particularly the former; consequently, recently cleared jungle land is usually suitable for its cultivation.

Harvesting. The stems are ready to be treated for fibre just before the plants begin to flower, when they are cut about a foot from the ground and the leaves removed.

EACH stem is then stripped into its component layers. The outer leaf-sheaths contain a coarser and stronger fibre than the inner, while the fibre from near the middle is of a fine silky texture. Inferior grades are suitable for paper manufacture.

Preparation of Fibre. In preparing the fibre, each strip is taken by hand, and drawn between a blunt knife and a smooth board attached to a light frame. The fibre is then dried in the sun and packed in bales for shipment.

THE first crop is obtained two years after planting, and a full crop in the fourth year, plantations continuing to yield for about fifteen years. The usual return is said to be from 600 to 850 lbs. of dry fibre per acre, from the fourth year; but, with good cultivation, the yield could be increased; half a ton per acre is usually regarded as very satisfactory.

MANILA Hemp has been grown at the Kuala Lumpur Gardens for some time, and the results thus far obtained, on even comparatively poor land, are extremely promising. The original suckers were procured from the Philippines and represent one of the commercial varieties grown there.

THIS fibre might be grown by the small holder, since Manila Hemp is prepared by hand labour, and there would be little difficulty in securing a market for this well-known product. The Department of Agriculture, S.S. and F.M.S., will not be in a position to supply suckers for some considerable time, as all its material is at present required for large scale experimental purposes. It is estimated that fifteen suckers can be obtained per plant annually, and it is hoped that the Department will be able, in time, to supply a large number for planting purposes. Suckers can be obtained from Manila at a cost of a $190.00 gold per thousand, and the Department can furnish addresses of growers. Manila hemp is quoted at £31.10.0 per ton, September, 1923.

ROSELLE FIBRE.

Hibiscus sabdariffa, var. *altissima*.

THERE are two varieties of *Hibiscus sabdariffa*, viz. *Victor* and *altissima*. It is from the latter that Roselle Fibre is obtained.

DURING the past two years a great deal of interest has been taken in this crop, the Department of Agriculture having distributed seed to nearly one hundred applicants, most of whom are cultivating it in a small way; there are, however, a few estates where it has been taken up on a commercial scale.

ROSELLE is well suited to Malayan conditions. As regards soil, it would appear to thrive best on friable loams, but it has been found to do well on soils varying from a sandy loam to a stiffish clay. Laterite lands are unsuitable. Well-drained flat land and gently undulating ground are equally suitable, but hill land is not recommended.

Planting should be carried out at the commencement of the wet season. The area selected must be cleared of all weeds, and the soil brought to a fine tilth by changkolling to a depth of 4 to 6 inches and breaking up the surface lumps of earth. This will provide an even seed bed for the reception of the seed. When weather conditions are favourable, the seed is broadcast at the rate of about 20 lbs. to the acre and lightly raked in. It is important to see that the land is thoroughly free from weeds previous to sowing as weeding, after this operation, is discontinued.

The crop is usually ready for harvesting when the plant commences to flower—viz. about 3½ months from the time of sowing. It has been noted, however, that flowering is sometimes delayed considerably, in which case the crop should be cut not later than the end of the fourth month from sowing. The best time for cutting is after rain, as the bast then comes away more easily.

Stripping the bast from the wood is accomplished by hand-labour; preferably in the field, in order to save transport. The bundles of bast are brought to the retting-tanks, which should be situated near running water for the washing of the fibre after retting.

The period of immersion in the retting-tanks varies slightly, but is generally from 8 to 10 days. Over-retting weakens the fibre and destroys its gloss. The fibre must be kept submerged in the water. After retting, the material is thoroughly washed in running water, care being taken to see that it is free from all foreign matter. The fibre is then sun-dried, combed and baled for shipment.

It is not advisable to grow Roselle continuously on the same land; two or three crops may be harvested, after which a suitable rotation, e.g. Roselle and Groundnuts, should be adopted.

The yield of combed fibre is about half a ton per crop, per acre; yields have been obtained, however, on one Estate, of 1,400 lbs. per acre.

The following figures were obtained on an estate in Perak, and are based on Roselle being grown as a catch-crop, with a yield of half a ton per crop, per acre.

Tillage to a depth of six inches, harrowing, sowing and other charges in bringing the crop into bearing ..	$0.65	per lb.
Cutting and Stripping	2.00	,,
Retting	2.00	,,
Baling	0.10	,,
Total cost on Estate exclusive of cartage and freight, etc. ..	$4.75	,,

i.e. $106.40 per ton.

The freight on 1 ton of fibre to London is as follows:—

Rail freight	$11.52
Charges receiving, etc., rail into store ..	3.20
Insurance, premium and stamp (Insured for £35)	1.98
Steamer freight to London and stamp ..	28.00
Charges of receiving, storing, forwarding and shipping	9.60
Bills of lading and stamp	1.50
	$55.80

making an all-in cost c.i.f. London of $162.20 or $81.10 per acre. The above figures presume effective baling at 50 cubic feet per ton, which is the allowance given by shipping companies. The acquisition of a baler is therefore essential for economical marketing.

THERE is a good local market for Roselle ropes, which are generally made by the grower, but only a small amount of this fibre is being exported. When Roselle is better known in the home markets there may be a larger demand for the product.

AS an annual it has possibilities as a catch crop in young rubber clearings. On rubber land of good quality soil and comparatively free from timber, two or more crops might be harvested, but it would be unwise to continue its cultivation after the rubber trees are about two and a half years old. Roselle grows to a height of from eight to twelve feet and should not be planted within a radius of five feet from the young rubber trees. It has also been observed to be attacked and killed by *Fomes lignosus*.

THE plant can be recommended as a minor crop in view of the fact that the fibre can be prepared so easily by hand labour and that machinery is unnecessary. The process of retting and cleaning the fibre could be economically undertaken by any small holder; but small areas would not warrant the introduction of a baling press, which is essential if packing and freight charges are to be reduced to a minimum. This difficulty, however, might be overcome by establishing baling centres. In areas of any size a baling press could be profitably installed.

Although the fibre is a valuable one, there will be difficulties at first in securing a market, particularly in the case of the small holder; but there is little doubt that, when it can be offered in commercial quantities, it will meet with a ready sale in the United Kingdom.

KAPOK.

(*Kabu-Kabu*).

The cotton tree (*Eriodendron anfractuosum*), known to the Malays as kabu-kabu or ka-kabu, is sufficiently familiar to residents in the Tropics to need little description. The tree is readily recognisable by its tall straight trunk, bearing at intervals horizontal branches, which during the fruiting period are devoid of leaves. The value of the tree and its suitability for Malaya are less well-known facts.

Kapok is used very extensively as a "filler" for mattresses, pillows and other articles of upholstery; and, on account of its buoyancy, and non-matting qualities, it is superior to almost any other filler. Moreover, if the kapok has become hard with much use, it rapidly regains its excellent properties when exposed to bright sunlight. Kapok has also found extended uses during recent years in life-saving apparatus, life-belts, buoyancy cushions and ocean jackets. Up to the present, kapok has not been found suitable for spinning, owing to its short fibre and extreme brittleness.

Kapok is found in practically all tropical countries, but until recent years had not been considered a crop suitable for plantation conditions. Java supplies 80 per cent. of the world's demand; the exports from that country in 1921 amounted to

over seventeen and a half thousand metric tons, exported mainly to the United States of America, Holland, Australia and England. Thus in 1921 Java received about one and a half million pounds sterling for kapok supplied to other countries. Other exporting countries are the Philippine Islands, Ceylon, India, and Venezuela. The standard kapok comes from Java and is known as Prime Samarang. The prices vary from *4d.* per lb. for Indian kapok to 15 pence per pound for that originating from Java. The interesting point in the production of kapok in most countries is that practically in every case the cultivation is in the hands of natives, the foreigner managing the marketing.

A census of the trees in the Federated Malay States and the Straits Settlements has been made, with the result that it is ascertained that, although almost all districts contain trees, the amount of kapok obtained is insufficient to meet the local demand. The exceptions to this were in Lower Perak, Kuala Kangsar and Krian Districts, which together contained about sixty thousand trees. The purchase of kapok by Chinese has yielded such poor returns to the Malay growers that the latter sell but a small proportion of their crop, and much of the kapok is allowed to rot *in situ.*

KAPOK will flourish in a wide range of soils, but those of a light friable nature, allowing easy development of the somewhat sparse root system, are preferable. In this country, the alluvial soils along river banks give the best returns, after which a sandy loam is suitable. In Java, the finest crops are obtained from the well-weathered volcanic soils of Samarang. Whatever be the soil, the drainage should be good, although occasional floods over the

area do not appear adversely to affect the trees. Hill land, or any land very subject to white ants, is less suitable, as white ants are the most serious pest of kapok trees in this country.

THE methods of cultivation of kapok must be judged mainly from general agricultural experience rather than actual knowledge of plantation conditions for this crop; for apart from new plantations in the Philippine Islands, Java, and Siam the crop has not been planted on a large scale.

THE land should be well cultivated, and kapok seed planted, either "seed to stake" or in a nursery. The best planting distance is twenty feet square, which allows just sufficient room for the branches, and space for other cultural operations between the rows. Growth is very rapid, and in the case of plantations planted seed to stake, a selection of the particular seedling to be left at stake must be made at an early stage. In so far as the kapok tree is concerned, no further cultural operations are considered necessary, although it is of advantage to the trees to retain the soil in a state of cultivation. It must be remembered too that when the tree comes into bearing, the ground must be fairly clear to facilitate harvesting operations. Kapok may also be planted from branch or stem cuttings, but this practice carries with it many objections. The trees thus propagated will commence bearing about one season before trees obtained from seed, but such trees are more liable to the attack of white ants, are more likely to fall in high winds owing to the absence of tap-roots, and have a much shorter life than trees obtained from seed.

The trees commence bearing in about four years from planting, when a small crop of perhaps fifty pods per tree might be expected. Thereafter the increase in crop is very rapid. Fruiting takes place once annually, January—May. At this season the leaves drop off and for three or four months the tree is without foliage and is ripening its fruit. A plantation of about eight years would probably give an average of 400 pods per tree. The life of the tree, planted from seed, may be as much as fifty years. The writer has seen trees of 35 years of age yielding over 1,000 pods per annum, and under plantation conditions such yields should be quite possible in younger plantations.

The pods should be plucked when ripe, and not allowed to fall when overripe, as is the practice in Java and Malaya. The average composition of the pods is as follows:—

Husk and Placentas	44%
Seeds	35%
Floss	21%

It is generally estimated that one hundred pods will produce 1 lb. of clean kapok.

Kapok seed contains over 20 per cent. of oil. Large quantities of seed are exported annually from Java. In 1912, nearly 300,000 piculs of seed were exported from Java, valued at about $600,000. The oil is employed in soap making and as an adulterant of other oils. The cake or meal, after expression of the oil from the seed, is a useful cattle food or fertilizer.

Much of the kapok from Java is cleaned or partly cleaned by hand; but in order to obtain first class floss, its subsequent treatment by machinery is

necessary. Several makers of machines are known, but perhaps the one with the greatest reputation is the Bley Kapok Cleaning Machine. It requires 1 horse power for its operation and is claimed to clean 217 kilos per hour. From the above it may be seen that the cleaning of kapok by machinery requires but a small outlay of capital.

KAPOK is exported in bales, and for this purpose a baling machine is essential. Balers cost from £24 to £100 and more.

BALING, of course, is essential to economise in shipping freights. The size of bale prepared varies according to the market to which the kapok is to be exported. For European shipments the bale is 1.60 piculs or 217.6 lbs.; for Australian shipment 1.20 piculs per double bale and 0.80 picul per single bale. Baling is best pressed into sacking or matting and bound with fibre.

THERE is a world-wide demand for kapok. The principal countries of import are Holland, America, Australia and New Zealand, and England. The Department of Agriculture are in a position to place sellers of kapok in touch with some fifty buyers in all parts of the world.

KAPOK is one of the few crops which does not appear to have been affected by the slump; the price for many years has been steady, and with constantly increasing demand as its floss becomes better known and more appreciated as a filler, together with the possibility of new uses, it appears probable that the market will remain firm for a considerable time. The outlay in establishing the crop and upkeep charges are small, and the machinery required for preparing the floss for market is inexpensive.

Moreover, any estate provided with machinery can attach kapok cleaning machinery to their shaft, as the horsepower required is small. The great advantage of kapok cultivation is that the land, in addition to bearing mature kapok trees, can, by reason of the little shade thrown by such trees, be utilized for a wide range of additional crops. In Java, vanila, coffee, cacao are frequently grown in this way. In Perak, limes are frequently so grown with success. The possibility of establishing a rotation of fibre crops under kapok is worthy of consideration. The more fibre crops that can be grown in conjunction with kapok the better, as the balers are more constantly used.

THE quality of fibre from Malayan trees compares very favourably with that produced by Sumatra, and it is probable that with better local methods of cultivation and the introduction of machinery, this country could produce kapok equal to that of Java.

THE Department of Agriculture have extended their enquiry on the cultivation of kapok, machinery, marketing, supply and demand, prices etc., and are in a position to give those interested more detailed information than is possible in this place.

COTTON.

COTTON of long-staple grades is not likely to be over produced in the sub-tropical and tropical countries of the world. Moreover, strenuous efforts, with large financial backing, are now being made by the recently formed Empire Cotton Growing Corporation to extend the culture of cotton in British Colonies and Protectorates, in order that

the cotton spinners of Great Britain may obtain adequate supplies of the raw material for their mills. Production of long-staple cotton is in danger of being restricted below normal requirements on account of the ravages of insect pests; and, further, the quality available for British factories is steadily diminishing owing to the increased consumption of this class of cotton by American manufacturers.

THAT every effort should be made to grow long-staple cotton is emphasized by the fact that high-grade cotton is required by the rubber and motor industries. Next to rubber, long-staple cotton is the most important raw-material used by these industries, and the outlook for the future is unsatisfactory because there is not enough of the best grades produced to meet the demand.

ATTEMPTS to grow cotton in Malaya have been made from time to time; but, hitherto, the results obtained cannot be considered satisfactory from a commercial standpoint, because the yield per unit area was either too low, or the quality produced was too poor.

ABOUT 1914, trials were made with Egyptian, American Upland and Caravonica cottons at the Kuala Lumpur and Batu Tiga Plantations, but the crop records of these experiments are not available. A comparatively good return, however, was reported. In 1921 a plot of Sea Island cotton was grown at the Kuala Kangsar Government Plantation. Owing chiefly to late planting, the yield obtained from it was small, but the Superintendent considers that the prospects of cotton-growing in the district are favourable.

At the Serdang Government Plantation, Egyptian and Sea Island varieties have been planted. Here, also, the results were unsatisfactory, apparently on account of unsuitable soil conditions.

Both at Kuala Kangsar and at Serdang the experience gained of the requirements of the crop is likely to prove valuable in connection with further experiments.

In other parts of the Peninsula, the 'kidney' or 'chain' cotton, (*Gossypium brasiliense*), Caravonica, Egyptian, Assam Indigenous, Garo Hill, Dwarf Patani, and other varieties have been grown on a small scale by planters. With the exception of selected strains of Egyptian and Caravonica cotton, all of these have coarse short staples, and are therefore of low value.

Although the prospects of cultivating the more valuable long-staple cotton in Malaya cannot as yet be estimated, recent trials indicate that a fair measure of success may be anticipated in average seasons. It is true that new problems connected with the crop may have to be solved; but, to date, the difficulties which have been encountered are for the most part those which were anticipated, and can be largely avoided by close attention to the requirements of the plant and the careful control of pests.

The most promising cottons in Malaya are those of Egyptian and Sea Island types. These cottons produce the finest, longest and strongest staples; they command the highest market-prices; and, further, they are derived from the same species, *Gossypium barbadense.*

As the market for the finest Sea Island cotton is very limited, types producing moderately fine grades of this class of cotton should be grown; these, together with selected Egyptian varieties, are required in large quantities in Great Britain. The plants can be grown as annuals—that is, they would occupy the land only for about seven or eight months of each year; this is a great advantage because pests can be better controlled, as will be described later. Again, the danger of natural hybridization and mixing of seed of long and short staple varieties would be avoided. Cotton from mixed, or hybridized, seed is hardly saleable.

It has been shown that long-staple cotton of good average quality can be grown in Malaya, provided that its cultivation and the time of sowing are given adequate attention and that pest control is systematised. The best time for sowing the crop would vary in different parts of the Peninsula, calculations being based on the necessity of rain for germinating the seed and the advantages of dry weather during the picking period. The incidence of pests, more particularly the cotton-stainer, depends somewhat on the presence of other host plants, "Kapok," "Roselle," and "Hibiscus," which would require to be destroyed or the pests found on them controlled in localities likely to be devoted to cotton.

The question of rainfall is not serious, since our rains in the growing season are of the nature of showers, though a certain amount of boll-shedding usually results. The extent of this boll-shedding would differentiate between good, average and bad crops in the same way that rainfall affects rice and

coconut crops. Experiments indicate that light, well-drained loams of average water retaining capacity, well worked up, should give the best results and that steep and stiff land should be avoided. Cultivation must be intensive, as opposed to present extensive methods, and this point would probably decide the success or otherwise of planting cotton.

THE eastern and northern States of the Peninsula offer the best prospects for cotton cultivation on account of their more defined wet and dry seasons and their lighter soils.

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MISCELLANEOUS CROPS.

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1923.

Miscellaneous Crops.

THE crops here described include some which have been cultivated previously in Malaya on a somewhat extensive scale, while others are either only in the experimental stage or have been shown to be somewhat unsuited to local conditions.

AS regards those which were formerly cultivated successfully, such as sugar-cane, coffee, tapioca and gambier, they have been gradually superseded through the introduction of rubber (*Hevea*), which gave at the time much higher returns on the capital invested.

THE vast increase in the demand for rubber, and the fact that the conditions in this country were particularly suited to its cultivation, resulted in this crop being planted on an enormous scale, during which period many old and established crops were eventually replaced.

THE cultivation of those crops which are only carried out on a small or experimental scale, such as cinchona, tea and tobacco, is never likely under present conditions to become extended, owing to competition with other countries, in which these constitute their main crops.

SUGAR-CANE.

(*Saccharum officinarum*).

THE sugar-cane is a tall grass or reed, reaching a height of from eight to twelve feet, and is found cultivated in all tropical countries. The chief countries in which it is grown on a commercial scale are Cuba, India, Java, Fiji, Mauritius, Guiana, Hawaii, Philippines and the West Indies. The cane-sugar of commerce is obtained from the juice of the sugar-cane, although the sugar beet yields a similar product.

History.—It is stated that sugar-cane was cultivated by the Chinese in Province Wellesley long before the colonisation of Penang, and cane-sugar was actually exported from Penang in 1805. Later the Malay Peninsula became one of the foremost sugar producing countries, sugar and coffee being the two principal crops grown on a commercial scale.

THE principal areas under sugar cultivation were in Province Wellesley and Krian, but about 1901 its cultivation was extended to Lower Perak. All these areas were gradually planted with rubber, replacing the sugar-cane, and, except for small areas where it is grown for eating purposes, its cultivation has been abandoned.

Varieties of Sugar-cane.—It is not possible in a brief article to give a description of the large number of existing varieties of sugar-cane, but it might be of interest to point out that some of the canes originally grown in this country, such as the "Selangor" * cane and the "Red Purple" cane of Singapore, formed the stock from which a number of new varieties have been developed. The two common

* Also known as the "Salangore" cane.

varieties formerly cultivated in this country on a commercial scale were the " Red Ribbon " and the " Large Yellow " or " Bourbon " cane.

Soil and Climate.—The plant requires a hot, humid climate, alternating with dry periods, and thrives best on flat land at low elevations, preferably situated on tidal rivers, which facilitate proper drainage and also provide a suitable means of transporting the cane to the factory.

THE most suitable soils are sandy loams, clayey loams and alluvial soils containing a fair proportion of clay. Light sandy soils, heavy clay or peaty land are all unsuitable. Good surface drainage is essential as the plant cannot tolerate a water-logged soil.

SUGAR-CANE is a somewhat heavy feeder, and manuring is necessary after the first or second crop.

Cultivation.—The land should be thoroughly clean and free from weeds, changkolled or forked to a depth of six to seven inches until it is brought into a fine state of tilth, and then made up into ridges four to five feet apart. If conditions are suitable, tractors may be employed in ploughing and harrowing the land previous to planting.

ALTHOUGH any part of the cane containing two or three eyes or buds can be planted, it is the usual practice to plant only the top parts of the cane, which contain less sugar. The tops or cuttings, usually eight to ten inches in length, are placed in furrows at intervals of two to three feet apart. They are planted in pairs a few inches apart in an oblique position, with only a small portion above the soil, which should be firmly pressed down.

IN order to avoid replanting, the canes after harvesting may be allowed to ratoon, that is, to grow up from the root-stocks. This method, however, was found to be unsuited to this country and only practised as a last resource when, owing to shortage of time and labour, it was impossible to uproot the old cane and replant in the usual way.

THE labour requirements for sugar-cane cultivation are fairly heavy, and it is estimated that at least one unit of Indian labour is required per acre, but this can be reduced considerably by employing mechanical power for cultivation and preparation of the land.

DURING the first six months after planting the soil is maintained in a friable condition by transferring the soil from the ridges to the furrows in which the cuttings are planted.

CANES grown from cuttings usually take about twelve months to reach maturity, but if a second or ratoon crop is allowed to grow from the old roots it will mature in from nine to twelve months.

IT is well-known that some varieties ripen earlier than others, whilst climatic conditions may accelerate or retard the period of growth.

Yields.—Shortly after flowering, when the canes become hardened and ripe, which can be seen from their general appearance, they should be cut as close to the ground as possible, since the sugar content is highest near the base. After cutting, the canes are tied into bundles and transferred to punts, bullock carts or trucks on light rails for transport to the factory.

UNDER favourable conditions, the average weight of cane per acre from plants in this country is twenty five tons, yielding about two and a half tons of raw sugar. A sugar content of twelve per cent. and a recovery of ten per cent. on the weight of cane would be a fair average for the types of cane previously grown in this country, but there is no doubt that by careful selection and breeding it is possible to produce improved strains, as is now the case in other cane-growing countries.

Manufacture.—There are two methods of manufacture, one in which Vacuum Pan sugar is produced and the other in which a product known as Basket sugar is obtained. The former process is elaborate and expensive, whilst the latter is somewhat crude and requires less machinery, with the result that the product is less valuable. In both cases the first operation is to express the juice from the cane; this should be done as quickly as possible after the canes are cut, as the juice is normally acid and fermentation, which lowers the content of sucrose or crystallisable sugar, sets in very quickly.

THE canes are passed longitudinally between heavy crushing rolls, and this either crushes or macerates the cane.

WITH ordinary metal rollers it is possible to extract about eighty-five per cent. of the juice in the cane, but with modern machinery as much as ninety to ninety-five per cent. can be extracted.

THE fibrous material left after the extraction of the juice is known as "Megass" or "Bagasse" and is used as fuel for raising steam for the evaporating pans and for power purposes in the mill.

VACUUM PAN sugar is prepared by subjecting the juice to a series of processes, the main objects of which are the arresting of inversion and fermentation by heating, the counteraction of acidity and the precipitation of various non-sugar and colouring bodies by the addition of lime. The subsequent stages are the concentration of the juice by boiling under reduced pressure in a series of vacuum vessels, granulation in a single vacuum vessel by further evaporation, and the separation of the grains of sugar from the molasses or uncrystallisable sugars in centrifugal machines.

MOLASSES, consisting chiefly of sucrose (crystallisable sugar), glucose (uncrystallisable sugar) and water, is a valuable bye-product from which rum is manufactured. It is now also used as a source of power-alcohol.

IN the manufacture of Basket Sugar, which is now rarely practised, the cane juice is neutralised in the ordinary way and boiled in open tanks or pans to a certain consistency, the scum being removed at intervals as it forms. The thick liquid is then run into shallow wooden trays, stirred and cooled quickly, when the mass will form into grains resembling fine sand. It contains all the impurities present in the juice and yields no bye-products.

THE above is only a very brief and broad outline of the process of manufacture. Modern sugar factory practice is highly organised under scientific control.

General.—When sugar-cane was cultivated in this country, sugar was produced at a profit, even with the local price of Basket Sugar as low as $6.00 to $8.00 per pikul*. This was only possible with the system of indentured labour and the low rates of wages in force at that time.

It is estimated that, under present conditions, the actual cost of production would be about $12.00 per pikul or £25 per ton, which leaves little or no margin of profit.

Providing costs of production could be reduced by cultivating improved strains giving a higher yield, and by the employment of machinery in the cultivation of the land, it should be possible to revive the industry in Malaya.

The production of large quantities of beet sugar in Central Europe, however, will always tend to keep down prices, and this factor should not be overlooked when the cultivation of sugar-cane is under consideration.

With a view to encouraging the cultivation of sugar-cane in Malaya, the Government of the Federated Malay States is prepared to consider applications for land for this purpose on specially favourable terms in respect of rent and export duty on sugar.

The Department of Agriculture has recently made a comprehensive collection of the principal varieties of local sugar-canes, and experiments are now being carried out to ascertain their relative values for cultivation on a commercial scale. Further, it is intended to conduct selection and breeding experi-

* 1 pikul = 133⅓ lbs.

ments with these and other varieties, which may be imported from time to time, with a view to obtaining improved strains which will give higher yields and be more resistant to disease.

TAPIOCA.

(*Manihot utilissima*).

TAPIOCA or cassava, a native plant of Brazil, is cultivated in all tropical countries for its large tuberous roots, which are used either directly as food or for the manufacture of the several forms of tapioca of commerce.

THE following figures show the exports of tapioca from the Federated and Non-Federated Malay States during the year 1921:—

	Federated Malay States.		*Non-Federated Malay States.*	
	Quantity.	Value.	Quantity.	Value.
	Pikuls	$	Pikuls	$
Flake	4,864	22,081	25,239	137,695
Flour	1,135	5,736	23,322	92,618
Pearl	10,615	76,540	170,338	1,026,654
Total	16,614	104,357	215,899	1,256,967

Cultivation.—Tapioca is propagated from stem cuttings, which are planted three feet apart. The cuttings should be five to six inches in length and are planted in a sloping direction. The stems are generally made up into bundles, each containing twenty pieces from four to five feet long, the usual price being fifteen cents per bundle; about twenty of these bundles are required to plant an acre. The

cost of planting is from \$4.50 to \$5.00 per acre. Apart from ordinary weeding, little or no subsequent cultivation is required.

There are two distinct varieties of tapioca, white and red, but the former takes longer to mature and is very seldom grown, except on a small scale.

Harvesting and Yield.—The first crop is ready for harvesting in fifteen to eighteen months from the date of planting and, under favourable conditions, should yield from one hundred and twenty to one hundred and fifty pikuls of roots per acre. The second crop, which is planted almost immediately after the first crop is removed, usually matures a little earlier, about thirteen to fifteen months after planting, and yields only eighty to one hundred pikuls of roots per acre.

It is estimated that one hundred pikuls of roots will yield fifteen pikuls of flour, but the percentage of flour decreases if the crop is over-ripe at the time of harvesting. In cases where the supply of mature roots is insufficient to keep the factory working, it is a common practice to harvest roots which are not fully ripe and which would normally be allowed to grow for a further two months. The yield of root in such cases is naturally smaller than when the plant is allowed to reach maturity. About one hundred pikuls per day are required to keep a factory of the usual size in regular work.

Manufacture.—The processes of manufacture of the commercial products are fairly simple. The roots are first passed through a washing machine, very large roots being cut in pieces beforehand. They are then transferred automatically to a hopper leading to the pulping machine which contains

graters revolving at a high speed. The grated pulp is carried away in a stream of water and passed through a sieve, which consists of a hexagonal framework covered with fine silk cloth and mounted on an axle at a slight inclination. The fine starch passes through the material of the sieve with the water and is run into settling tanks, while fibre and other debris are discharged at the lower end of the sieving apparatus. After settling, the clear liquid is run off and fresh water added, the starch being stirred with paddles. This operation is repeated several times, until all foreign matter has been removed, the starch being allowed to settle in the tanks of fresh water. The wet, compact mass of starch is then broken up or rubbed through a coarse sieve, heated in shallow iron pans over open fires for a short time, and then placed on heated tables until thoroughly dry, when it is ready for the market.

THE three common grades of tapioca, which are manufactured locally are (1) flour, (2) flake or granulated, and (3) small and medium pearl, but there is no doubt that a large quantity of fine pearl tapioca finds its way into the local market under the name of sago.

Uses.—The tubers are used as a food by natives, the fresh young root being ground and made into meal or bread as a substitute for rice. The tapioca of commerce obtained from the roots, as described above, is used as a food-stuff and for the production of starch and glucose. It is also used for sizing yarns and fabrics and for the manufacture of dextrin. The roots are also considered to be a possible source of power alcohol.

General.—At present the cultivation and manufacture of tapioca on an estate scale is carried on entirely by Chinese.

THE market value of tapioca has improved recently, the local prices (Oct. 1923) now ruling being:—Small flake \$11.75, medium pearl \$13.75, and small pearl \$14.00 per pikul respectively, which are considered sufficient to give a profitable return.

GAMBIER.

(*Uncaria Gambier*).

GAMBIER is a tanning material obtained from the leaves and twigs of *Uncaria Gambier*, which is a large shrub, indigenous to Malaya.

ITS cultivation in this country has always been in the hands of natives, the Chinese being the principal exporters of this product.

THE following are the exports of gambier from the Federated and Non-Federated Malay States for the year 1921:—

	Federated Malay States.		*Non-Federated Malay States.*	
	Quantity.	Value.	Quantity.	Value.
	Pikuls	$	Pikuls	$
Bales	696	6,388	18,606	160,138
Cube	4,348	46,434	4,881	44,339
Total	5,054	52,822	23,487	204,477

THE principal countries to which it is exported are the United States of America, the United Kingdom and India.

Cultivation.—The plant is propagated from seed which is sown in nurseries. The seed deteriorates rapidly and, in order to ensure good germination, great care must be taken to obtain fresh seed. One pikul of fruits will produce sufficient seedlings to plant one hundred acres. The nursery beds should be shaded and the young plants carefully watered during dry weather. When the seedlings are about three inches high, which is at the age of five to six months, they are ready for transplanting in the field. Transplanting should only be carried out during wet weather, otherwise it will be found difficult to establish the plants. The most suitable distance of planting is 6 ft. x 6 ft., or 1,210 plants per acre. After transplanting, little or no cultivation beyond ordinary surface weeding is required, but careful attention must be given to supplying, and any dead plants should be replaced by fresh seedlings from the nursery.

Harvesting.—The crop, which consists of the leaves and young branches, may be first collected at about fifteen months from the time of planting, and further croppings repeated at intervals of four to six months, according to the condition of the growth; should a period of drought follow the pruning, the plants take much longer to recover than when pruning is followed by rain. The prunings, which are from one to two feet long, should be selected from the side branches and never from the main shoots. The number of shoots cut from each plant varies considerably and only the most vigorous shoots should be selected. Under suitable conditions, cropping may be continued for a period of about ten to twelve years, when the land is allowed to become fallow and to revert to "blukar" or secondary jungle.

Extraction.—The manufacture of gambier is very primitive, the product being obtained by boiling the leaves and shoots in water, and concentrating the extract so produced until it solidifies on cooling and stirring. The boiling process is carried out in large, deep pans over open fires. The solid extract is cut up into small blocks and placed on racks under cover, where it remains for seven to ten days until quite dry. These blocks are then pressed together, packed in grass matting and covered with gunny sacking, each package containing about half a pikul. This is marketed as gambier in bales and does not fetch such a high price as cube gambier. The latter requires more attention in its preparation, is free from foreign matter, of a much better colour and, being cut into cubes an inch square, contains less moisture than the crude product sold in bales.

Yields.—With regular prunings from plants grown on good soil a yield of eight to ten pikuls of dry gambier per acre per annum should be obtained.

THE present prices (Oct. 1923) for gambier are $17.00 per pikul in bales, and $30.00 per pikul for No. 1 cube, unpicked; this leaves a good margin of profit.

Uses.—Gambier is an important tanning material, giving a peculiar gloss to leather, which is not produced by other tanning substances. It is also used extensively as a dye in the silk trade.

LIBERIAN COFFEE.

(*Coffea liberica*).

LIBERIAN COFFEE is a strong growing species indigenous to Tropical West Africa. The tree is distinguished readily by its considerable height (about

25 feet, if left unpruned), its large, thick leaves and comparatively large berries. It is only suited to cultivation at low elevations.

Cultivation.—The plant thrives well on soils fairly rich in humus; peaty land, providing it can be properly drained, is said to give the best returns. The seed should be carefully selected from only perfectly ripe berries and, after depulping, is mixed with dry ashes and spread out to dry in a warm, shady place. The dried seed is then planted about one inch deep at distances of 6 to 9 inches apart in raised nursery beds, which are covered with heavy attap shade. The beds require careful watering during dry weather, and the shade should be removed gradually as the young plants develop. The seedlings may remain in the nursery beds for 3 to 4 months but, providing the shade has been reduced, they may be removed to the field when they have only 2 to 3 pairs of leaves. At this period they stand transplanting better than if allowed to remain longer in the nurseries.

THE distance of planting in the field should be about 15 ft. x 15 ft., or 193 trees per acre. The seedlings should be transplanted in the wet season, the tap-root being cut off with a sharp knife when the young plants are removed from the nursery. The planted areas should be clean weeded.

WHEN the bushes are about 6 to 7 ft. high they should be topped in order to facilitate the collection of the ripe berries. Pruning is done throughout the year, at intervals of about two months. No permanent shade is required.

LIBERIAN coffee has a vigorous constitution and is more or less resistant to leaf-disease.

Harvesting.—The bushes should begin to produce fruit about 3 years from the date of planting, and are considered to be in full bearing after the 5th. or 6th. year. Fruit is borne throughout the year, during which time two heavy crops may be expected, one about May/June and the other about December/January. Only fully ripe berries should be harvested as the pulper cannot deal with unripe fruit.

THE plant required for preparing the crop for market is simple and should consist of a small engine, water pump, pulper, huller, and a fermenting tank.

THE preparation of the coffee is as follows:—The ripe fruits are washed through the pulper, in which the pulp on the fruits is crushed and removed in a stream of water; the residue is then fermented for about two days, when the remains of the pulp can be easily washed off. The pairs of seeds are then dried, when they are termed "parchment." They are then put through a huller to liberate the seeds, which are separated from the broken parchment by winnowing. The seeds or beans are then ready for the market.

ABOUT 10 pikuls of berries produce 1 pikul of coffee.

THE present price (Oct. 1923) of the dried beans in the local market is about $40.00 per pikul.

ROBUSTA COFFEE.

(*Coffea robusta*).

ROBUSTA COFFEE is a species introduced from the Congo, where it was discovered growing wild. This species grows much more rapidly than Liberian, and is different both in habit and appearance. The handsome wavy leaves are a lighter green. thinner

and larger in size, and there are more berries on each cluster. The robusta berries are much smaller, but the beans are almost the same size as the Liberian.

Cultivation.—The plant grows best on a loose clay loam or a red laterite type of soil but, unlike Liberian, it is unsuited to peaty land. The seed is sown in shaded nursery beds at distances of 6 to 10 inches apart, according to the length of time before transplanting. The shade should be removed gradually, so that the plants are fully exposed when they have four pairs of leaves, at which stage they are also ready for planting out.

THE distance of planting may vary on different types of soil, but should not be greater than 10 ft. x 10 ft., which gives 435 plants per acre. After planting, the area should be clean weeded. To induce branching, the plants should be topped when they reach a height of about 6 to 8 feet. The plant requires less pruning than Liberian, but it is commenced at an earlier stage.

ROBUSTA does not appear to be very susceptible to disease, but it is not free from the leaf-disease peculiar to coffee. It is probably more liable than Liberian to attacks of insect pests.

THE plants begin to flower when eight months old, but the early flowers do not always set. Robusta blossoms throughout the year and the berries should therefore be collected once a month. The berries mature within about ten months of flowering, and are ready for picking when the greater number in the cluster become straw-coloured; the whole cluster may be generally gathered at once. A small crop may be collected in the second year, while the

maximum will be obtained in the fourth year, after which the yield remains fairly uniform. The plant continues to yield well for at least 9 to 10 years. The estimated yields per acre from the second to the fifth year are as follows:—

2nd. year	..	1	pikul (133$\frac{1}{3}$ lbs.)
3rd. ,,	..	5— 6	,,
4th. ,,	..	12—14	,,

THE berry is much smaller than that of Liberian, and the pulper used for the latter is entirely unsuitable; a small Lidgerwood pulper is the most suitable.

AFTER pulping, the beans are fermented for 36 hours, are then well washed, transferred direct to the drying house, and dried as quickly as possible. While in the drying house, the beans should be turned frequently to ensure uniform drying. Coffee so prepared retains its colour and has a good flavour.

APPROXIMATELY 4 pikuls of berries will give 1 pikul of dried beans.

THE present local price (Oct. 1923) of robusta coffee is about $30.00 per pikul.

SAGO PALM.

(*Metroxylon Sagu*).

THE sago palm is a pinnate-leaved palm, 30 to 40 ft. high, with a short cylindrical trunk, from which is obtained the greater part of the sago of commerce. THE palm thrives exceedingly well in Malaya and may be found scattered throughout the country, being most abundant in padi fields and swampy, low-lying lands, particularly in Negri Sembilan,

Malacca, parts of Perak, Johore and Kelantan. It is not, however, cultivated to any extent in this country for its sago, nearly all the sago manufactured in Singapore being prepared from raw sago imported from the surrounding islands.

In addition, the palm is useful on account of the fact that, after it has grown for about 5 or 6 years, the leaves may be cut and used for making "attaps" for roofing purposes. The attap from this palm is far superior in lasting qualities to that obtained from the nipah palm.

Cultivation.—The sago palm grows best on marshy land on which it is almost impossible to grow any other tropical crop with the exception of padi; it will even grow in many places where padi has been tried repeatedly without success.

It may be propagated either from seed or suckers; the latter method, although being both unsatisfactory and costly, is that usually adopted. Suckers are generally expensive to procure, especially if transported long distances; experience shows that, unless they are most carefully removed from the parent tree, which is very seldom done, they will not survive after being planted out.

On the other hand there is a considerable advantage to be gained by propagating seeds in nurseries, and transplanting the seedlings when about 12 to 18 months old; for not only is this method less expensive, but the results generally prove to be far more satisfactory.

Care should be taken in the selection of the seed, as there are two varieties of the palm, "smooth" and "spiny." This leads to a difficulty when growing from seed, as they do not always breed true and

hybrid spiny types may be produced. The difficulty may, however, be overcome by selecting the seedlings before planting out. Suckers of course will always remain true to type. The smooth-stemmed variety is the more prolific.

THE seeds are planted about 1 ft. apart in slightly raised nursery beds and should be ready for planting in the field after 12 to 18 months. The seeds in the husks are planted just below the surface and shaded until the young plants bear three leaves. The area to be planted should be cleared, and holes dug for the seedlings not less than 15 ft. x 15 ft. apart, giving 193 palms to the acre. The roots of the plants should not be disturbed more than necessary when transplanting, all the roots being properly covered during this operation. For one or two years the plants should be circle-weeded, and any "blukar" or undergrowth cleared sufficiently to prevent interference with the growth of the palms. After this period, little attention will be required, any by leaving one sucker to replace each palm cut out, the ground should be continually productive without much, if any, replanting.

AFTER about 9 or 10 years, or when the palms commence to flower, they reach maturity and are then cut down for sago production. About 50 trees per acre will mature about the 9th. year, after which an annual crop of 50 trees per acre may be expected, as those cut down will be replaced by suckers produced from the roots of the original palms.

THE height of a full grown palm is usually 30 to 35 feet, and the girth from 50 to 60 inches. The mature stems are bought by Chinese at from \$1.50 to \$2.00 each for the manufacture of sago.

Manufacture.—The palm is cut into logs about 3 to 4 ft. long, the bark removed, and the pith split lengthwise into quarters. The pith is then passed through a rasping machine which grinds it to a fine powder. After passing through the rasper, the powder falls into a revolving washing machine which separates any fibrous matter from the sago; the refuse is discharged from the end of the washing machine, whilst the sago passes through the gauze netting with which the washing machine is lined. The sago and water then flow into long narrow troughs about 8 inches wide and 24 to 30 inches deep, arranged in series, an opening being left at the top to allow the water to pass from one trough to another. The sago is deposited gradually in the form of a white powder, the quantity becoming smaller as each trough is passed until the last one is reached, in which there should be no deposit. After drying the powder, in the sun or by artificial means, the sago flour is placed in sacks for shipment. A tree of average size will produce about 2 pikuls of sago flour.

PEARL sago is made by squeezing the damp flour through a cloth into a sieve, perforated with holes of the required size, from which it falls into a shallow iron pan heated over a fire.

Uses.—Sago flour is used principally for size in the manufacture of cotton piece goods, for starch, and in the preparation of chocolate, corn-flour and mustard, while pearl sago is used for making biscuits.

THE local prices (Oct. 1923) now ruling are: Sago flour $5.75 per pikul, and Pearl sago $8.30 per pikul.

CLOVES.

(*Eugenia caryophyllata*).

THE clove tree is a small conical tree, indigenous to a number of islands in the Moluccas. It is generally about 12 to 20 feet tall, but in some places may attain a height of 40 feet. The cloves of commerce are the dried, unopened flower-buds. The tree is cultivated on a large scale in Zanzibar and Pemba, but also in Penang, Amboyna, Sumatra, Ceylon and the West Indies.

Clove Industry in Penang.—The clove plantations in Penang, which were formerly of importance, are now almost entirely in the hands of Chinese and Malays, who have interplanted rubber, coconuts, and other products amongst the clove trees, with the result that the latter have been gradually forced out of cultivation on many of the plantations. This is responsible for the big decline in the local production.

Cultivation.—The clove does not thrive far from the sea, and grows best on sloping situations up to an elevation of 1,500 feet. The most suitable soil is a dark loam overlying a subsoil of clay mixed with gravel.

THE tree is grown usually from seed, but can be propagated by layering. The seeds are sown 4 to 6 inches apart in nursery beds about 5 feet wide, which should be slightly raised and shaded. The beds are watered morning and evening if the soil has become dry but, after the plants are above ground, watering should be less frequent. When the plants are about 6 inches high they should be gradually hardened by partially removing the shading, and left in the beds exposed to the sun

for a month or two before planting. The seedlings are usually kept from 9 to 12 months in the nursery beds; they should be planted in the field at distances of 25 to 30 feet apart. The tap-root should be kept straight when the young seedling is transplanted. If dry weather is experienced after planting, the young plant must be watered until it begins to throw out fresh leaves. It is sometimes considered advisable to grow the cloves at first under light shade trees, which are removed when the plants become slightly larger. Pruning is very seldom practised, but it is often advisable to cut out some of the inner branches, if these are too crowded. Apart from keeping the ground clean-weeded and clearing the trees of parasites and epiphytes, to the attacks of which they are liable, no other treatment is required until the flower-buds begin to appear. Manuring with cow-dung, or mulching with cut grass or lalang, is however very beneficial to the trees in the early stages of growth.

In Penang, the clove tree commences to produce flower-buds in the fourth or fifth year after planting, but it may be considerably later if the soil is inferior. The buds are ready for gathering from November to January. They are at first green, then become yellowish with a pink tint, and finally dull blood-red, when they are fit to gather. When seed is required, the buds are allowed to remain on the trees until fully ripe, which takes a further three months. The buds are usually gathered by hand, a hooked stick being used to pull down the higher branches. Cloves should be picked in the best condition, neither too young nor too old. After collecting, they should be separated from the stalks and leaves, then spread on dry mats in direct sunlight, placing them under

shelter at night to prevent wetting by dew. This operation is repeated for about seven days, or until dry. Drying with artificial heat is often practised with satisfactory results.

Yields.—In this country a single tree will produce about five lbs. of cloves in a season, which, allowing 100 trees per acre, gives a yield of about 500 lbs. of dry cloves per acre. Higher returns up to about ten lbs. per tree can be expected on the best types of land. The best cloves are large and plump, only slightly wrinkled and of a light purplish brown colour with a purplish bloom. If dried too rapidly, they become black.

Clove Oil.—A large quantity of cloves is consumed in the manufacture of clove oil, the inferior qualities being mostly used for this purpose. The ground cloves are distilled in steam to obtain the essential oil, which amounts to from 15 to 18 per cent. Clove oil is rich in eugenol, from which synthetic vanillin, similar to the active principle of vanilla, is produced.

The flower-stalks, separated from the cloves during drying, are sometimes dried and distilled. They contain about 5 to 6 per cent. of oil and usually fetch from 3*d.* to 6*d.* per lb. for distillation purposes.

Uses.—Cloves are used primarily as a spice, the first grades being in special demand for this purpose. They are also used to a small extent by natives as a masticatory, being mixed with betel-nut and sireh leaf.

Clove oil is used principally in perfumery as well as in medicine and microscopy; alcoholic extracts of clove oil are used for flavouring confectionery and liqueurs.

Market Price.—The present price of cloves (Oct. 1923) in Penang is $110.00 per pikul.

THE most recent London market price (Sept. 1923) for Penang cloves is 2*s*. 6*d*. to 3*s*. per lb., and Zanzibar cloves from 1*s*. 2*d*. to 1*s*. 5*d*. per lb. The oil is quoted at about 7*s*. 6*d*. per lb.

General.—The cloves of Penang have always been highly valued, and have maintained their superiority from the commencement of the cultivation in 1798 to the present day, although the exports from this country are now comparatively small.

ZANZIBAR is now the greatest clove producing country, exporting over 9,000 tons annually. The market value of the Zanzibar cloves, however, is less than that of those exported from Penang.

NUTMEGS.

(*Myristica fragrans*).

THE nutmeg is a bushy tree about 30 to 40 feet in height, a native of the Moluccas, and introduced into Penang in 1798. The tree is cultivated for the nutmeg and mace of commerce, the chief countries in which it is grown being Banda, Sumatra, Java, Amboyna, Penang, Celebes, the Moluccas and the West Indies.

Nutmeg Industry in Penang.—The industry in Penang, which is now entirely in the hands of Chinese and Malays, is of considerably less importance than formerly, the plantations both in Penang and Province Wellesley having been gradually replaced by coconuts and, during more recent years, by rubber.

Cultivation.—The nutmeg is usually cultivated on hillsides from about 200 to 1,500 feet, but is rarely found growing at sea-level.

In Penang, in which are produced the finest nutmegs in the world, the trees are grown on the steep, exposed slopes of granite hills, on which the soil consists of yellow loamy clay, characteristic of the laterite formations of the Malay Peninsula. Bare clay slopes or sandy soils are considered unsuitable, whilst wet or low-lying ground is fatal to its growth.

The nutmeg is propagated from seed; only large well-formed seeds should be selected for this purpose. Seeds of irregular shape, or of a pale colour, should be rejected, also those which rattle in the shell on shaking. The seed should be planted as soon as possible after collection, since it loses its vitality quickly.

The seed is planted in well-prepared nursery beds, composed of good soil, at distances of about 12 to 15 inches apart and at a depth of two and a half inches. The beds should be shaded and watered every other day, or more frequently if necessary. The seeds germinate usually in four to six weeks. It is advisable to reduce the shading of the nurseries gradually. The young plants remain in the nurseries till they are from six to nine inches high, or for a period of about six months, after which they are transplanted. Planting in baskets is sometimes practised with good results.

The young seedlings are planted in the field at a distance of twenty-five to thirty feet apart. The holes for planting should be at least three feet wide and three feet deep, and filled with good surface

soil and leaf-mould. The tap-root should be kept straight, the soil in the hole well pressed around the root and filled slightly above the level of the surrounding ground to allow for sinking. In hot and exposed situations the plants require shading until they have become established, but the shade can usually be removed after ten to fourteen days. Although permanent shade in the form of light-foliage trees is considered advantageous to the nutmeg, the trees in this country are frequently grown in the open.

AFTER the plants are established, they require very little attention beyond keeping the ground clear of weeds around the trees. Mulching with cut grass or light manuring with well decomposed cow-dung is very beneficial, particularly on poor soils, since the nutmeg is a heavy feeder.

PRUNING is seldom necessary, but all dead branches and parasitic plants should be removed.

SINCE the nutmeg is unisexual, that is male and female flowers are borne on different trees, the number of male trees should be reduced, if necessary, leaving one male to every ten or twelve female trees. Unfortunately, it is impossible to distinguish between the two until they begin to flower.

Yield.—The trees usually commence to fruit between the fifth and sixth year, but may take even eight or nine years to come into bearing. They attain maximum productivity at fifteen years and fruit well for a further ten to twenty years. Trees which commence to fruit early are invariably very short-lived. The fruit is sometimes allowed to fall, but it is preferable to collect it from the tree, using,

if necessary, a hooked stick to pull down the higher branches. A good worker in the full fruiting season will collect from 1,000 to 1,500 fruits per day.

THE tree fruits throughout the year, but the heaviest crop is obtained usually in July and August. The whole fruit consists of three parts, (1) the husk, (2) the mace and (3) the seed or nutmeg of commerce.

THE yield of nutmegs from individual trees varies considerably, but good trees should average 1,500 to 2,000 fruits a year. A yield of 750 lbs. of nutmegs and 120 lbs. of mace per acre is, however, considered satisfactory under ordinary conditions.

Preparation of Nutmegs and Mace.—A few days after collecting, the fruits burst open and the mace is detached from the seed by opening it from the top and turning it back. The fresh mace is of a brilliant red colour, rather tough and leathery, and possessing a peculiar turpentine odour. After removal the mace is flattened out, either by hand or between boards. It is then placed in the sun for a few hours each day until dry, which takes from ten to fourteen days.

THE husk and mace having been removed, the seed, which is still in the shell, is dried in the sun in the same way as the mace. When the seeds are dry they rattle in the shell on shaking, and are stored in the shells. As soon as sufficient stocks have been obtained, the shell or seed coat is cracked, which is done either by striking one end with a wooden mallet, or more economically by machinery. After the seed is removed from the shell it is very liable to the attacks of insects, especially if stored for any length of time.

NUTMEGS are valued according to size; and, after cracking, they must therefore be graded. The three common grades are those averaging 65, 85 and 110 nuts per lb. respectively. Defective or broken nuts are converted to powdered spice by grinding, and used for seasoning or preparation of nutmeg butter and essential oil of nutmegs.

THE graded nutmegs are packed in cases or casks for export.

THE local price for nutmegs at the present time (Oct. 1923) is \$55.00 and \$48.00 per pikul for 80's and 110's respectively.

THE latest London quotations for nutmegs are:—65's at 1*s.* 6*d.* per lb., 80's at 1*s.* 1*d.* and 110's at 10½*d.*, whilst oil of nutmegs is quoted at 4*s.* 6*d.* per lb.

Uses.—The nutmeg contains about 25 per cent. of a fixed fat which constitutes the nutmeg butter of commerce, prepared by crushing the seeds and pressing the heated meal.

THE nutmeg also contains an essential oil, which is obtained by steam distillation of the pulverised nutmegs, the yield being from eight to ten per cent. Mace also yields an essential oil related closely to that of the nutmeg.

BOTH nutmegs and mace are used principally as spice and flavouring agents; nutmeg butter is used medicinally as a basis for ointments, whilst oil of nutmegs or mace is employed in perfumery and for flavouring liqueurs.

PEPPER.

(*Piper nigrum*).

THE true pepper is a perennial creeping vine, indigenous to Ceylon and Southern India. Both the black and white peppers of commerce are obtained from the dried fruit of the same plant.

THE plant is cultivated on a commercial scale in Java, Sumatra, Malabar, Ceylon and the West Indies. It was formerly cultivated on a large scale in Penang, but the industry has now practically died out.

Cultivation.—The pepper vine requires a moist heat with shade, and thrives better on flat land than on the slopes of hills. The most suitable soil for pepper is one rich in humus; with the aid of manures, it has been grown successfully on stiff yellow clay soils in Malaya.

THE vine is propagated from cuttings, selected from the tops of the best yielding vines, care being taken not to obtain cuttings from male vines only. The cuttings, which should be about one foot long, are planted in well-prepared nursery beds and buried six inches in the ground. The beds are shaded and watered carefully when necessary. After about a year, the cuttings should have become established and can then be transplanted.

THE plant requires support, either in the form of hardwood timber or light-foliaged trees. *Erythrina* trees, when grown from cuttings about 3 feet long and 2 inches in diameter, are very suitable as supports, the best kinds being *E. lithosperma* and *E. stricta; Morinda tinctoria* is sometimes used for this purpose. These are planted 7 feet apart and lopped when necessary.

When the vine cuttings are ready for transplanting, they are lifted from the nursery beds and planted a few inches away from the supports, facing east. In this country the Chinese do not utilise living trees to support the vines, but grow them exclusively on stout hardwood posts, about twelve to fourteen feet long and six to seven inches in diameter, which will not be destroyed by white ants or decay during the life of the pepper plant. The posts give practically no shade, and the ground between them is usually covered with cut lalang, to act as a mulch.

As the vine ascends, it is tied to the post with soft bast or twine and, on reaching the top, is pulled down and wound round the base of the support. The vines are sometimes manured with fish manure at the rate of about ½ lb. per plant.

Periodical pruning is necessary to prevent the plant from growing bushy at the top; by the time it has reached the top of the support, it will have been pruned at least three times.

Yields.—The vines will commence fruiting as early as a year after planting, but no fruits should be allowed to develop until the plant is fully grown, which will be about the third or fourth year after planting, when it will cover the stake completely. There are generally two crops per annum, one in August or September and the other in March or April, but collection often continues throughout the year. The vines are considered to be in full bearing at the sixth or seventh year and, with proper treatment, will continue to yield well for 12 or 15 years.

After the sixth or seventh year, an annual yield of 3 to 3½ lbs. of dry pepper per vine is obtained

which, with 889 vines to the acre, is equivalent to approximately 2,500 to 3,000 lbs. of dry pepper per acre per annum.

Curing.—Black pepper consists of the ground whole, dried berries. When this form of pepper is required, the spikes are gathered when only a few of the fruits are ripe and red, and placed on mats to dry in the sun. The quality of the pepper can be improved considerably by plunging the berries into boiling water for a few minutes immediately before they are spread to dry. This " kills " the green fruit, which would otherwise take some time to wither, and accelerates the drying process. When the pepper is dry it turns black and is then rubbed by hand to separate the stalks, which are removed by winnowing.

When large quantities of berries have to be dried quickly, drying rooms with artificial heat are generally used.

White pepper consists of the ripened berries, deprived of their black covering before grinding. In order to obtain a white pepper of good quality the gathering is delayed until nearly all the berries on the spikes are of a red colour, but since the fruits on the same spike ripen so irregularly this is not always possible.

After gathering, the fruits are detached from the branches by pressing them underfoot. The berries are then put in large bags and placed in running water, where they are allowed to soak for seven to ten days. When the skins are sufficiently loose and soft, the berries are put into tubs, where they are stamped underfoot in a little water and washed

until all the skins, pulp and stalks are removed. The pepper-corns are then removed from the tub and placed on mats to dry in the sun.

THE local prices (Oct. 1923) for pepper are:—Black \$15.50 and White (Sarawak) \$23.00 per pikul, respectively.

Uses.—The chief use of pepper is as a spice or condiment. It is used also for medicinal purposes.

IPECACUANHA.

(*Psychotria Ipecacuanha*).

THE ipecacuanha plant is a small perennial indigenous to the dense, humid forests of Brazil.

MOST of the ipecacuanha of commerce is derived from Matto Grosso in Brazil. The United Kingdom imports about 50,000 lbs. annually, and the United States of America a similar quantity.

Cultivation.—The plant is propagated readily from root cuttings, which should be taken preferably from mature plants. The cuttings are prepared by slicing the fresh roots with a sharp knife into small pieces about a quarter of an inch in length. These are placed in a horizontal position in boxes of specially prepared soil consisting of a mixture of two-thirds sand and one-third humus. After planting the cuttings, a thin layer of sand is put on the surface and the cuttings are watered carefully. Under such conditions the cuttings will strike in about one month and, at the end of two months, they should be pricked off about four inches apart into other boxes filled with equal parts of sand and jungle

mould. Shade and moisture are essential, and under careful management the rooted cuttings should be ready to plant in permanent beds at the end of six months.

When the young plants are sufficiently large, they should be planted at distances of from twelve to eighteen inches apart in well-prepared beds about five feet wide, the soil having been previously trenched to a depth of at least two feet to allow the roots to penetrate. Raised beds are preferable, and good drainage is essential. After planting in the permanent beds, the surface soil should be kept loose by light forking with small hand forks to a depth of two or three inches, at intervals of about a month. The plants require shade throughout their period of growth, and regular watering during dry weather. Excessive moisture, however, is detrimental and care should be taken to give only the requisite amount.

Yield.—The roots may be harvested at about two to two and a half years from the date of planting in the permanent beds. A healthy plant will yield from six to eight good roots, which, after drying, weigh from one to two ozs. On a large scale the average yield is usually much less, the estimated weight of dried root being about 600 lbs. per acre per annum.

The roots are prepared for the market by drying them as quickly as possible. The common method employed is sun-drying, the roots being placed under cover at night to avoid damp caused by dew. Drying can be accelerated considerably by using artificial heat, without affecting the quality of the roots.

IPECACUANHA is prepared from the dried roots of the plant which yield only about one per cent. of the drug, consisting of the three alkaloids, emetine, cephaeline and psychotrine.

THE present market price of dried root is 8*s*. per lb.

Uses.—The pure alkaloids and an extract of the roots are used in medicine. The principal alkaloidal constituent, emetine, is used largely as a specific for dysentery.

General.—Although ipecacuanha has been grown successfully in this country, particularly in Selangor and Johore, it should be noted that there is only a limited demand for this drug, and any attempt to cultivate the plant on a large scale would have the effect of reducing its market value considerably. Further, its cultivation requires much labour and supervision and, therefore, the plant is costly to grow on anything approaching a field scale.

TOBACCO.

(*Nicotiana* spp.).

THE tobacco plant is an erect annual, 4 to 7 feet high, with viscid leaves and stems. The varieties now cultivated originated from *Nicotiana Tabacum* and *Nicotiana rustica*, indigenous to South America. The dried, cured leaves constitute the tobacco of commerce. Tobacco is one of the most widely cultivated crops, being grown on a larger or smaller scale in most countries possessing the requisite climatic conditions.

Cultivation.—Tobacco grows best on alluvial or light sandy loams, rich in potash, lime and humus, heavy

clay soils being unsuitable. A hot, humid climate favours its growth, but a dry season is necessary for harvesting.

THE plant is propagated from seed sown in shaded nursery beds. As the seed is minute (an ounce containing about 400,000 seeds), it should be mixed with fine sand or wood ashes, and broadcasted on the surface. The beds after sowing are flattened down with a piece of wood to ensure the soil being pressed around the seeds. The shade is removed gradually and the seedlings are ready to transplant when 4 or 5 leaves are formed, usually from 4 to 6 weeks from time of sowing. They are then planted in rows about 4 feet apart, at a distance of 2 feet apart in the rows. The young plants are lightly shaded and, if the weather is dry, watered for a few days until established, when the shade can be removed. At about 6 weeks from planting the flower-buds begin to appear. These are nipped off and, at the same time, all lateral shoots removed, so as to divert the vigour of the plant to the leaf.

Harvesting.—About 6 weeks later, the plants will be ready for cutting, the mature leaves being a yellowish green, with brown spots on the surface, and the edges and tips curling downwards. The leaves are removed separately as they ripen, from the base of the plant upwards. The cut leaves are then carried to the drying house where they are spread on the floor to wilt, then tied into bundles of 25 to 30, and strung on poles to wither and dry gradually. This operation usually takes about 3 weeks, drying being complete when the mid-rib becomes soft and brown in colour. When sufficiently dry, the leaves are taken down, sorted into hands of about 14 leaves, according to quality, and then

placed in large heaps to ferment. The heaps are heavily weighted and the position of the hands changed about every 2 days. After about 8 to 10 weeks the leaves will be cured and are then graded for the market. Each plant will yield usually from 8 to 10 marketable leaves.

General.—Apart from small areas planted by Asiatics (usually Javanese), little tobacco is grown in Malaya, that produced being generally of poor type, and prepared for smoking without having been fermented previously. The product is rank and strong but meets the requirements of the native consumers.

The native growers state that they obtain a yield of about 3 pikuls of tobacco per acre, which is sold locally at from \$90 to \$100 per pikul.

One of the advantages of growing tobacco in this country is the import duty, the present rates in force being as follows:—

Cigars and Snuff	..	\$ 1.20	per lb.
Cigarettes	..	0.80	,, ,,
Native and Leaf Tobacco		20.00	,, pikul.
Other Tobacco	..	0.80	,, lb.

There are good possibilities of extending the production of a low grade tobacco, but it is doubtful whether the development of this crop on a large scale would be a success.

DERRIS (TUBA).

(*Derris* spp.).

The Malay "tuba" includes a large number of plants used as fish poisons, not necessarily belonging to the genus *Derris*; two species namely *Derris*

elliptica, Benth. and *D. uliginosa* are known to contain, in their roots and stems, substances toxic to certain insects.

An investigation is being carried out in the Department of Agriculture to ascertain the relative toxicities of the numerous local plants which go under the name of "tuba," and the best methods of preparing suitable insecticides for use against various classes of insect pests. This will be followed by experiments on the most suitable methods of cultivation of those plants showing a high toxicity.

Chinese gardeners, although appreciating the value of *Derris*, grow it on a relatively small scale, mainly for the purpose of providing an insecticide for use in their vegetable gardens. Considerable quantities of the dried roots are used in the manufacture of certain proprietary insecticides; and, judging from enquiries received from England, it would appear that there is a good demand for the dried root.

As a result of these enquiries, a number of estates are becoming interested in its cultivation on a small experimental scale in case the demand increases. The cultivation of the plant presents no difficulties and, as it is amenable to light shade, there is no reason why it should not be grown as a catch-crop amongst young rubber or coconuts.

Cultivation.—Derris may be propagated readily by means of stem cuttings, eighteen inches long, planted in sandy soil. If exposed to the full sun, it is advisable to remove the leaves to prevent the stems from dying from excessive transpiration. Under light shade, the cuttings root earlier, often within six weeks from the date of planting.

THE method of cultivation adopted by Chinese market gardeners is to plant long cuttings, which have been twisted into a circle, at distances of about six feet apart, and allow the plants to ramble over the land. During growth, pig manure is applied to the soil. The crop is not harvested at one time, but roots are lifted as required.

AS a sole cultivation, the best results will be obtained by ridging the land. The ridges should be made three feet apart, the soil being worked into a fine tilth during the operation. *Derris* will grow in most soils, but is partial to a clayey loam containing a fair quantity of sand. The cuttings should be placed on the ridges at a distance of three feet apart, giving 4,840 plants to the acre.

THE roots mature according to cultural conditions, the average period of growth being two years. The weight of fresh roots obtained from a single plant varies from one to two pounds according to the distance of planting. The average weight of roots per plant obtained on the Experimental Plantation, Kuala Lumpur, was one pound and a loss of weight of 40 per cent. took place during drying.

THE retail price of the root in the local market at the present time (Oct. 1923) is about 30 cents per kati*, the wholesale price being from $20.00 to $25.00 per pikul.

BETEL NUT.

(*Areca Catechu*).

THE betel or areca nut palm, native to Malaya, is a graceful tree with a straight, unbranched stem reaching 40 to 50 feet in length, and bearing a crown of from six to nine large, spreading, pinnate fronds.

* 1 kati = 1⅓ lbs.

THE betel nut industry is now slowly dying out, owing to the native preference for planting rubber, although there is a fairly large number of betel palms growing in the Muar district in Johore. In a very few cases are the betel nut plantations under the control of the original owners or planters, who were mostly Malays; the common system is to hire them out on contract, usually to Chinese, who collect and sell the fruit.

Cultivation.—Only virgin jungle land is suitable for the cultivation of betel nuts, and it is stated that, if planted on other types of land, the palms make poor growth and yield little fruit. The palms are usually planted about 8 ft. x 8 ft. apart, giving 680 trees to the acre. Very little weeding is done, and there is always a fairly thick undergrowth of lalang and other weeds. The land is never manured or cultivated, in fact the plantation is allowed to look after itself until it reaches maturity. Fortunately, little trouble is experienced with pests and diseases.

THE palm bears flowers and fruit after the fourth or fifth year, and continues to yield for fifteen to twenty years. As each leaf dies and falls off, it discloses a swollen leafy sheath in the axil. This sheath quickly ruptures and sets free the inflorescence, which is composed of a large number of small, pale-yellowish flowers. The fruit ripens within about six months after the first appearance of the inflorescence.

THE young palms bear from two to six bunches of fruit per year, while older palms bear one or two bunches a year and finally do not fruit at all. All

the bunches of fruit do not appear simultaneously, but the young palms may have fruit and inflorescence in different stages at the same time.

THE average number of fruits to a bunch is about two hundred, so that, on the average, a palm produces six hundred fruits (three bunches) per annum, yielding seven and a half katis of dried nuts. The yield of prepared nuts should be fifty one pikuls per acre per annum, on the basis of six hundred and eighty trees per acre.

Preparation.—The fruits, which are collected when ripe, consist of a thick outer husk of coarse fibre enclosing the nut. It is very difficult to separate nut from husk when the fruit is gathered, but, when dry, this can be done quite easily. The natives classify the finished product according to the methods of preparation, which are is follows:—

Pinang blah.—In the preparation of "Pinang blah," the fruits are split in two parts and spread out, split side upwards, in the sun. The nut is removed easily after two or three days. Care must be taken to protect the fruits from rain, otherwise their value will be impaired. The husks are used as fuel by those who prepare "Pinang salai." The nuts are dried thoroughly and placed in sacks for the market. Most of the nuts in the Muar district are prepared in this way.

Pinang mossi.—The fruits are placed in heaps to dry and the heaps are turned occasionally during three months, by which time the husk is easily removed; the nuts are then dried and packed, but are inferior in quality to "Pinang blah."

Pinang salai.—" Pinang salai " is a smoked preparation of betel nut. The fruits are placed on a bamboo grating, supported by mud walls. A fire of old betel nut husks is made under the grating; this smoulders, giving off a large quantity of smoke, which rises through the grating and thoroughly smokes the fruits. After about five days the nuts can be removed from the husks, and are then dried in the sun for a couple of days, when they are ready for sale. These smoked nuts fetch the best price.

Pinang asin.—" Pinang asin " is obtained by placing unripe fruits (green), mixed with salt, in sacks for two or three months; this product is only prepared to a small extent in the Muar district.

Uses.—The betel nut is used extensively in the East as a masticatory, and it has been estimated that one tenth of the whole human race indulge in betel chewing. It is said, by those addicted to the habit, that it strengthens the gums, sweetens the breath and stimulates the digestive organs.

In addition to its use as a masticatory, it is employed as a drug, and as an ingredient of various tooth pastes.

The present local market price (Oct. 1923) is 18 to 20 cents a kati, the export value being about $10 per pikul.

NIPAH.

(*Nipa fruticans*).

The nipah palm is found growing wild on the banks of tidal rivers, and in coastal swamps throughout the Malayan Archipelago, where it attains a height varying between 15 and 30 feet.

NIPAH is a promising source of sugar, alcohol and vinegar, whilst the leaves are very valuable for the production of roofing material, known as "attap."

THE sap is obtained by tapping the stalk of the partially ripe fruit, which varies from 3 to 5 ft. in length. Since the inflorescence of the nipah palm is near the ground, the spathe is conveniently situated for the collection of the sap. Some time after the fruit is formed the stalk is cut across the top just below the fruit, and each day a thin slice of the stalk is removed to keep the wound fresh, thus rendering the flow of sap more or less continuous.

THE nipah palm in Malaya differs from that in the Philippines in respect of the fruiting, which is not definitely seasonal in this country.

UNTIL quite recently, no attempt had been made in this country to exploit nipah, but during the last two years it has received the serious attention of many members of the planting community.

STATISTICS and general information, such as yield of sap and sugar content, are at present being collected by the Department. A preliminary report on the information so far obtained has already been published.

THE volume of sap shows great variation, as much as a gallon per day having been obtained by tapping three spathes on one palm, while others with one spathe have given only a few ounces daily.

THE sugar content of the sap has also been found to vary between wide limits, as much as 23 per cent. being found in some samples, and as little as 8 per cent. in others.

As a general rule, it will be found that the sap has a low percentage of sugar, if obtained from palms yielding a large volume, while that obtained from palms giving a small volume has a high sugar content. The period over which any particular spathe will yield sap varies from two to six months.

It would appear that the most satisfactory way of estimating yields is on the daily sugar content. The mean yield of sugar of a number of palms selected at random has been found to be between 6 and 7 ounces per palm per day. A conservative estimate of the annual yield of sugar per acre, based on a sugar content of 6 ounces per day, with 100 spathes in tapping at any one time*, and 300 tapping days per annum, amounts to nearly 9,000 lbs. of sugar per acre per annum. This is equivalent theoretically to a yield of absolute alcohol of over 1,100 gallons per acre per annum.

At present, nearly all nipah in this country is in the wild state, little having been planted systematically. Systematic planting has been effected only by natives, by whom the palm is used for making attaps.

The work so far carried out, and the results obtained in this country, are based on observations of nipah palms growing in "kampong" or small-holdings; it is possible that, when the palms are growing in the conditions of a plantation, various factors will modify considerably the yields of sugar produced.

* It is assumed that about 200-300 palms per acre is the correct number, so that the above estimate is based on only one spathe on every other palm being in tapping at any time; whereas it is an established fact that a palm may have three spathes in tapping at any one time, whilst some have been found with as many as ten fruit-heads at one time.

CINCHONA.

(*Cinchona* spp.).

CINCHONA is obtained from the bark of several species of *Cinchona*, which are medium sized trees, 25 to 40 ft. high, indigenous to South America.

THE two species most commonly cultivated are *Cinchona Ledgeriana* (Ledger's bark) and *C. succirubra* (Red bark). The former is much richer in quinine than the latter, and is the species chiefly grown in Java, which is now the biggest quinine producing country in the world.

CINCHONA thrives best at an elevation of 2,000 to 5,000 ft. and requires a rich loamy soil, preferably of volcanic origin.

THE plant is propagated from seed, which is sown in specially prepared seed beds, the seedlings being transplanted later to distances of about 3 to 4 ft. apart. Where virgin land is available, it is generally planted with *Ledgeriana* seedlings, but land on which this variety has been cultivated previously is usually replanted with grafted stocks of *Succirubra-Ledgeriana*, that is *Ledgeriana* grafts on *Succirubra*.

FROM the third or fourth year after planting, cropping by selective thinning and pruning is carried out throughout the year, and is continued for a period of 15 to 25 years according to the nature of the soil. The percentage of quinine in the bark is at its maximum about the eighth year after planting.

WHEN ready for cropping, the trees are lifted with the roots intact, since both the root and stem bark are rich in alkaloids. The bark is removed and dried in artificially heated drying rooms at a temperature of about 80° C., the resulting product being used for the manufacture of quinine.

It is estimated that about 600 lbs. of dried bark per acre per annum can be obtained on good cinchona plantations in Java. The average quantity of alkaloids in the dried bark is usually about 6 to 7 per cent.

Quinine is used only for medicinal purposes, principally in the treatment of malarial fever.

So far this crop has only been grown experimentally in this country.

VANILLA.

(*Vanilla planifolia*).

Vanilla is the product of a large climbing orchid, indigenous to Central America, but now distributed widely throughout the tropics.

The vanilla of commerce is obtained from the cured pods.

The plant is propagated from cuttings, which are first struck in the nursery and later transplanted into the field. Owing to its climbing habit, it requires support in the form of a hardwood trellis or a shade tree of light foliage, such as the " dadap " (*Erythrina* spp.).

Flowering should commence in the third year, the flowers requiring artificial pollination. The pods begin to ripen about 4 to 5 months after pollination, and should be gathered immediately they show signs of turning yellow. A vine should not be allowed to bear more than 25 to 30 pods.

The drying and curing of the pods after gathering is an important operation. This consists in dipping them into boiling water for a few seconds, then

drying in the sun, after which they are fermented in blankets, the drying and sweating process being continued until the pods become quite brown. They are then stored for a month before packing.

THE cropping of vanilla is very irregular, causing considerable fluctuations in the market price.

VANILLA is used as a flavouring agent, chiefly for confectionery and liqueurs.

THE cultivation of vanilla has been attempted in this country; but, since the period of ripening coincides with the wet season, it is not altogether a success, the pods being apt to fall before they are ripe and are thus spoilt.

CINNAMON.

(*Cinnamomum zeylanicum*).

THE true cinnamon is a medium sized tree, native to Ceylon and Southern India, 20 to 40 ft. high, but in cultivation is grown as a coppiced bush. The dried bark furnishes the cinnamon of commerce.

THE tree is usually grown from seed sown in nursery beds in clumps of about 25 seeds, the clumps being placed about 6 inches apart. After about one year these clumps are transplanted into the field to distances of 6 feet apart. Little cultivation is necessary beyond keeping down high weeds and particularly climbing plants.

THE shoots are ready for harvesting in the 3rd. or 4th. year, and cutting takes place twice a year during the rainy seasons. Shoots selected for cutting are usually of two years' growth. These are cut, the

tops and branches removed, leaving sticks from 3 to 4 ft. long. The bark is then peeled off, collected in bundles, pressed and bound together. It is then covered with matting and allowed to ferment slightly, in order to facilitate the removal of the cuticle. The pieces of bark are then sorted and dried, being packed together one inside the other to form pipes. These pipes are then further dried in the sun and graded for export.

The dried bark is used mainly as a spice, but is also utilised for medicinal purposes and in the manufacture of incense.

So far, cinnamon has only been grown on a small experimental scale in Malaya.

COCAINE.

(*Erythroxylon Coca*).

The coca or cocaine plant is a small bushy shrub, 6 to 8 ft. high, indigenous to Peru and Bolivia, where it grows wild at elevations of 4,000 to 6,000 feet. The drug cocaine is extracted from the dried leaves.

The plant is easy to cultivate and grows very rapidly from seed. The seed is sown in nursery beds, the seedlings being transferred after 7 to 9 months to the field, and planted at distances of 4 to 6 feet apart.

The first picking of leaves can be made at about 1½ to 2 years from the date of planting, after which several pluckings of leaves can be made each year. Only mature leaves which have the highest alkaloidal content should be picked. The leaves are

dried, in the shade or by artificial heat, to retain as far as possible their light green colour. The dried leaves should be packed for export in airtight cases to keep out moisture and to prevent fermentation.

It is estimated that, under good conditions, a yield of about 1,500 lbs. of dried leaf per acre per annum can be obtained.

The drug cocaine is used in medicine, chiefly as a local anaesthetic. The plant is not grown in this country to any extent, its cultivation being allowed only under licence.

TEA.

(*Camellia Thea*).

The tea plant, indigenous to China, Japan and India, varies in height according to the variety, some of which, if left unpruned, may attain a height of from 30 to 40 feet. In cultivation, however, the plants are topped and kept as bushes. The dried leaf provides the tea of commerce.

Tea is propagated from seed, which is sown in shaded nursery beds. After about 10 months the seedlings are ready for planting in the field. The distance of planting is from 4 to 5 ft. apart and the plants are topped about 18 months after transplanting.

The first picking of leaf commences in the third or fourth year, according to elevation, subsequent plucking taking place every 10 days. When the bushes cease to flush they are pruned back severely,

this being necessary at intervals of 15 to 18 months at low elevations, and 3 to 4 years at high elevations. The plants are in full bearing when about 6 years old, and continue to yield for many years.

PLUCKING consists in nipping off by hand the tender terminal leaves with the bud and the shoot. The pluckings are brought into the factory where they are withered, dried, rolled, and finally sifted into various grades for export.

OWING partly to lack of suitable land at the necessary elevations, the cultivation of tea has not been developed in this country. Small isolated areas are, however, to be found, the product being consumed by the native population.

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Plant Diseases & Pests.

THE following account deals with the problems of diseases and pests of economic plants in Malaya under three headings:—Fungoid and Bacterial Diseases, Insect Pests and Methods of Inspection and Control.

FUNGOID AND BACTERIAL DISEASES.

THE study of fungoid and bacterial diseases in their true relation to extensive cultivation is of comparatively recent date, and it is only during the last two decades that the losses accruing to cultivators have been realised and approximately estimated. The extent of the losses caused by crop diseases is illustrated by the following figures given by various authorities in America.

(1)	California Vine Disease in 1892	G. $10,000,000
(2)	Wheat Rust in United States 1898 ..	67,000,000
(3)	Wheat Rust in Illinois in 1885	1,875,000
(4)	Potato Late Blight in New York 1904 ..	10,000,000
(5)	Potato Blight in United States (annual) ..	36,000,000

Plantation Conditions in Relation to Rapid Spread of Diseases. Before proceeding to deal with specific crop diseases of local interest, it may be instructive to indicate the chief reason why plant diseases become more dangerous when a jungle tree, such as the rubber tree, is cultivated under plantation conditions. In the natural forests every tree is a survivor in the struggle for existence and only the hardiest individuals come to maturity. In the jungle, the mature trees or groups of trees of any single species are usually separated from the individuals of the same species by trees of widely differing constitution. Specialization or preference for one individual host, or at most a narrow range of hosts, is a well-known phenomenon in the case of parasitic fungi, so that, under jungle conditions, a diseased tree may be found, but the fungus causing it cannot attack the neighbouring trees because their constitution is so widely different from that of the attacked tree. Plantation conditions are diametrically opposed to those of the jungle—the struggle for existence does not operate to the same extent, since each seedling plant has similar conditions and many comparatively weak individuals survive. The weak individuals may be attacked more easily by disease, and since each tree has a similar constitution to its neighbour, every single tree in the plantation may become infected. Plantation conditions, as a rule, favour rapid spread of disease and it is easy to realise that the greatest care is necessary in the case of the cultivation of a jungle plant taken from its native habitat.

Diseases of Rubber.

PRIOR to 1912 little definite research work had been carried out on the diseases of the rubber tree.

During the last decade, however, many investigators have been engaged on disease problems wherever *Hevea brasiliensis* has been established on a large scale, so that our knowledge of the more important aspects of rubber diseases is now fairly extensive. It is important to mention here that information obtained in respect of diseases in one country does not necessarily apply, without modification, to other countries. Growth conditions in different countries may vary enormously, and this may influence the conclusions to be drawn from any research to such an extent that any recommendations may apply only in the country concerned. Any conclusions stated in this article must, therefore, be regarded as not necessarily applicable to countries other than Malaya.

Rubber diseases in Malaya can be classified as:—

(*a*) root diseases.
(*b*) stem and branch diseases.
(*c*) bark diseases.

THE above divisions are self-explanatory with the exception of (*c*). Bark diseases are so called because they occur when the tree is tapped for the extraction of latex. The latex flows from the cortical tissues when a thin paring of cortex is excised by the tapping knife. The tapping is done at regular intervals, usually once per day or once every two days, and each tapping exposes a thin strip of tender tissue and forms a suitable place of entry for certain fungi. Bark diseases are, therefore, diseases of the tapped surface.

Root Diseases. In dealing with root diseases, reference must be made to the method of opening up the land previous to planting. Most Malayan plantations are started on virgin jungle

land. The jungle trees are felled, leaving the stumps in the ground, and the luxuriant undergrowth is cut down. After a period of dry weather the timber and dried undergrowth over the felled area are fired. After the fire, the stumps and large logs, though much charred, still remain and during decay form suitable food material for fungi. The original source of the root diseases of *Hevea brasiliensis* can be traced to the jungle stumps and logs left on and in the ground. If the land were cleared thoroughly before planting it could be stated definitely that root diseases would be negligible on Malayan rubber plantations.

THE following root diseases have been investigated in Malaya:—

Fomes lignosus (*semitostus*).

THIS fungus causes most damage on young plantations with trees under seven years of age. Occasionally in localised areas it has caused considerable devastation. Most plantations have suffered loss from this disease; but since, owing to close planting, the trees have to be thinned out at the age of six or seven years, the loss caused by this disease has not, in the past, had serious consequences.

THE distinguishing characteristic of this fungus is the white external rhizomorphic strands running over the lateral roots of the tree. The fruit-bodies are remarkable in being persistently sterile, while similar fruit-bodies of closely allied species produce millions of spores, each capable of infecting a healthy tree under suitable conditions.

Sphaerostilbe repens.

THIS fungus causes a root disease of rubber trees, of any age, growing in acid, water-logged soil, and

is most common in the coastal areas. Occasionally this fungus destroys large areas of rubber but usually its action is slow and only individual trees are attacked.

THE more characteristic features are the flat, black, interweaving rhizomorphic strands, seen closely adpressed to the wood when the bark is removed from the diseased roots, and the fruits of the fungus which, when present, are typical though rather minute. The soil round the roots of an attacked tree and the diseased wood as a rule give off a most unpleasant odour when freshly dug up.

Ustulina zonata.

THIS fungus disease is wide-spread, and numerous cases can be found in many old plantations. The fungus is capable of attacking any part of the tree, i.e. root, stem or branch, if the wood is exposed. It often works in conjunction with boring beetles; the insects, after penetrating the wood, are followed by the fungus, and, in such cases, the trees are killed very rapidly. The fungus often enters the stem at places where large branches are broken off by the wind or other agencies.

IN all cases in which *Ustulina zonata* is active in tissues of *Hevea brasiliensis*, the appearance is the same,—a typical dry rot of the woody tissues with numerous conspicuous black lines, running through the rotted wood. The disease is most common on trees over eight years of age.

Fomes pseudo-ferreus (Wet-Root Rot).

THE action of this fungus on roots of *Hevea brasiliensis* is very distinct from that of *Ustulina zonata*. *Fomes pseudo-ferreus* produces a typical "wet-rot," in whatever situation the attacked tree

is growing. The disease is very dangerous on account of its subterranean habit, for an attacked tree usually blows over before the disease appears above soil level. When a tree is found attacked by this fungus it may be assumed that a number of neighbouring trees are also affected. This disease has caused large losses on many of the older plantations, but is seldom found on young trees.

THE wet-rot of the freshly-dug roots together with the inconspicuous brownish lines in the attacked tissue serve to diagnose the attacks of this fungus.

Brown Root disease.

THIS is not a common disease on rubber but the appearance of attacked roots is quite typical. The mycelium of the fungus binds up earth and stones in the immediate proximity of the roots to form a firm encrusting mass, which is detached with difficulty. The Brown Root disease is a common feature in other tropical cultivations, *e.g.* tea, coffee, camphor, which will show similar symptoms. This disease is under investigation at the present time, but little definite information has been obtained.

IN these diseases, control measures take the form of preventing the spread of the disease by trenching round the affected areas, removing and burning dead wood, and applying lime before supplying.

Stem and Branch Diseases. Only two stem and branch diseases require to be mentioned, viz. Pink disease and Die-back disease.

Pink Disease.

THIS disease is caused by a fungus known as *Corticium salmonicolor*, which on *Hevea brasiliensis* shows varied manifestations. Prior to 1912 the

disease was common in only three small centres but in 1913-14, it assumed epidemic form, and spread rapidly, practically throughout the whole Peninsula.

THE name, Pink Disease, is associated with the commonest appearance, a continuous pink incrustation covering the attacked branches. The other manifestation, which calls for most attention, is the "Necator" stage which occurs in the form of a series of orange red pustules. These are made up of cells which vary much in size; under suitable conditions the component cells break apart and are blown about as single-celled spores. The "Necator" was originally believed to be a fungus different from that causing Pink disease, and was named *Necator decretus*. During wet weather Pink Disease becomes very active, and it may be necessary to increase the number of coolies in the "Pest gang" in order to control the disease. Painting the affected branches with tar, or with a mixture of tar and crude oil, is an effective control, if the disease is taken in hand at an early stage.

Diplodia cacaoicola.

"DIE-BACK DISEASE." The fungus, *Diplodia cacaoicola* is a wound parasite which can enter through the smallest wounds, and is a common disease in all plantations, more especially when growth conditions are adverse. After this fungus has entered the tissues, it passes up and down the water-conducting vessels very rapidly, and prevents the upward passage of water to the leaves, which wilt and die. The threads of the fungus, dark in colour, cause a pronounced ashy-grey discoloration in attacked wood, which is very characteristic. A noticeable feature, at times, is the association of

this fungus with lightning; a group of trees is scorched by lightning and *Diplodia* enters the scorched tissues to grow very rapidly, so that in a few days a group of dead, leafless trees is found.

Bark Diseases. Before 1916 Malayan rubber plantations had not suffered seriously from bark diseases, though plantations in Java and Ceylon had been severely affected for many years. The most prevalent disease, previous to 1916, was " Black Stripe " disease, the fungus held responsible being a species of *Phytophthora*.

Black Stripe.

THIS disease assumed epidemic proportions in certain districts in Malaya in 1916. A *Phytophthora* was isolated and shown to be the cause of the disease. Weather conditions play a large part in determining the appearance of Black Stripe epidemics, continued damp and misty mornings being exceptionally favourable to the fungus. A dry weather period assists in bringing the disease under control.

" *Mouldy Rot.*"

THIS disease, caused by the fungus *Sphaeronema fimbriatum*, is a serious disease of the tapped bark of rubber trees in Malaya. It has recently been reported from Java, associated with outbreaks of Black Stripe disease. Until two years ago the disease was very localised, but recently there has been a serious extension of the area affected by the fungus. This disease is not easy to control, but the damage to the tapped surface can be avoided at a reasonably low cost if control measures are correctly applied. These take the form of painting the affected surfaces with disinfectants at definite intervals.

Brown Bast.

THIS bark affection has attained considerable prominence during the last few years, one of the most interesting features to the layman being that no investigator has yet succeeded in establishing a definite organic cause, i.e. fungus or bacterium. The generally accepted opinion is that no parasitic organism is concerned, but that the affection represents a morbid physiological condition which is influenced by excessive tapping. The symptoms are difficult to describe briefly, but the ultimate result of a Brown Bast attack is the cessation of latex flow from the tapping cut. All dry trees must be suspected, but it may be pointed out that trees often cease to yield latex from causes other than Brown Bast. Numerous experiments are in progress in most rubber growing countries to determine the factors influencing the development of this bark affection.

Spotting of Prepared Rubber.

DURING the years 1911-1913 planters experienced much trouble owing to coloured "spots" and "flushes" appearing in their rubber, particularly pale crepe rubber, in the drying sheds. These discolorations have been proved to be due to minute fungi and bacteria, which, growing in the moist rubber, produce red, yellow or violet pigments. These fungoid and bacterial discolorations still appear sporadically, but outbreaks are now usually controlled fairly easily, since it is known that the "disease" is invariably due to bad conditions in the drying rooms. Rubber however frequently becomes spotted, due to damp conditions, after it has been despatched from the estate.

Diseases of Coconut Palms.

In Malaya, coconut palm diseases have not hitherto called for much attention. The general situation in respect of coconut plantations is the opposite to that of rubber. The coconut palm is indigenous to Malaya or was introduced naturally, and grows crowded together along river banks owing to the fruits being suitable for water dispersal, and plantation conditions more or less simulate those obtaining in nature. It is therefore probable that no physiological strain is imposed under plantation conditions, and the trees have every chance of developing along the proper lines.

A few diseases of coconuts, the most important of which is Bud-Rot, require mention.

Bud-Rot.

"Bud-Rot" is a general term and the disease has been recorded on most palms, e.g. areca palm, African oil palm and palmyra palm. The mature leaves of palms surround the growing point, forming a very substantial protective sheath. The growing point, from which the newly developing leaves arise, is part of a large mass of spongy tissue, very rich in food materials, known as the cabbage or bud. If this bud is injured in any way, and micro-organisms effect an entry, a rapid rot is caused and the firm bud tissues disintegrate to a soft, pulpy, evil-smelling mass, the growing point being involved in the general destruction. The evil odour indicates the rapid putrefaction which is being caused by different kinds of fungi and bacteria. When the tissue of the growing point is wholly destroyed, no further growth can take place and the palm dies.

BUD-ROT is an epidemic disease in the Philippines and the West Indies, but no epidemic has been reported in Malaya. The cause of Bud-Rot in the Philippines is said to be the fungus *Phytophthora faberi:* in India and the West Indies, *Phytophthora palmivora.* Observations in Malaya suggest that more investigation is necessary before a definite cause can be assigned. Inoculations on oil palms and coconut palms with both the above mentioned species of *Phytophthora* have, so far, proved unsuccessful in Malaya.

Pestalozzia palmarum.

THIS fungus is present wherever coconut palms are grown in Malaya. Healthy palms suffer little damage although the fungus may be growing on the leaves, but if the palms are growing under adverse conditions a serious set-back is often caused. Large portions of the leaf tissue are killed and the fruit-bodies of the fungus appear as minute, black elevations about the size of a pin's head, in the dead leaf tissue. The fungus also attacks the African oil palm.

Helminthosporium incurvatum.

THE fungus—*Helminthosporium incurvatum* is not commonly found attacking palms in Malaya, but on two occasions has caused some trouble. The attacked palm-leaves generally present a scorched appearance and, if the blackened portions are carefully scraped, the hyphae and typical spores of the fungus are found. This fungus has also been observed on African oil palms.

MANY other interesting diseases of coconut palms have been noted but not investigated. The above mentioned diseases of the coconut palm are often found attacking the African oil palm. A peculiar

disease also found on young African oil palms has been noted, the cause of which is obscure. In the early stages, from the first to the third year, the third leaf from the centre collapses at the base. This is followed gradually by the collapse of the outer leaves, so that finally only a single central leaf may be standing rigid. The youngest central leaves are left uninjured, and growth continues. Normal new leaves are developed, so that the final appearance is of a number of collapsed diseased leaves, below a normal development of rigid leaves. The growth of the tree is, perhaps, retarded for twelve months, but finally recovers.

Diseases of Other Crops.

DURING the last three years much attention has been given to the possibility of establishing agricultural industries, other than rubber and coconut cultivation, on an economic scale. The cultivation of the African oil palm is promising and the diseases so far encountered are similar to those of the coconut palm. Fibre plants of the Agave family have claimed considerable attention, but the leaves of these plants are generally strong and leathery, and do not form attractive feeding places for fungi. The plant *Hibiscus Sabdariffa* var. *altissima*, from which roselle fibre is obtained, appears very subject to eel-worm attacks. A bacterial disease, a wilt, and a die-back, are being investigated.

WITHER-TIP, a serious disease in the West Indies, has been observed on lime trees, which are now being cultivated on a plantation scale, but is causing little damage. A root disease, with symptoms similar to those shown in the case of rubber roots attacked by *Ustulina zonata*, has been under investigation. It is to be expected that the serious root

disease of lime trees in the West Indies caused by *Rosellinia bunodes* will be found in Malaya; this fungus has already been found killing young "kapur" stumps in this country. Pink disease has also been recorded on lime trees in Malaya.

SPECIMENS of diseased banana plants, Sea Island cotton, and castor oil plants, have been received for investigation. It may be expected that, if any of these crops are planted on a large scale in Malaya, serious plant diseases will appear.

INSECT PESTS.

IN the process of clearing jungle and growing a particular crop to the exclusion of all other plants, the natural balance of vegetation is upset. Insects which feed on related plants, finding abundant food material, will naturally increase to great proportions. As the cultivation of one kind of plant proceeds, the insects which feed upon it may be expected to become more abundant, for they find a plentiful and easily accessible supply.

LOCAL insects are not always, however, entirely responsible for the damage done to crops. Insects which may be established pests in their own country, or which might gradually become such in other surroundings, are often imported into a new country. Such imported insects are frequently more injurious than the local ones, since the latter are generally kept in check by birds, other insects and diseases. Imported pests are rarely accompanied by their natural enemies, and hence increase to great numbers and do enormous damage before they are attacked by the natural enemies of similar native insects.

LITTLE attention has been paid by planters in Malaya to the control of insects, but with the cultivation of crops other than rubber and coconuts the need will arise. Insects have been observed injuring all the economic plants cultivated experimentally or otherwise in Malaya. Insect pests can, however, be overcome largely by keeping the plants in good health by the application of sound agricultural principles, and by the judicious use of insecticides.

THE following notes on insect pests of economic crops in Malaya are not complete, and can only be described as a rough guide for those interested in planting in this country.

Pests of Coconuts.

THE most important insects attacking coconuts in Malaya are described below:—

Rhynchophorus schach, Oliv., (*Curculionidae*), (The "Red Stripe" Weevil).

THIS is an insect well-known throughout Malaya, but is not the most deadly, since it cannot attack sound trees. The larvae cause injury by boring through the tissues of the palm in all directions. When full grown they change to pupae inside cocoons, which are composed of twisted fibres.

THE female weevil lays eggs in damaged parts of the coconut palm. One-day old grubs have been found capable of entering a palm through the tissues of a petiole cut at a distance of 36 inches from the trunk, and weevils have been observed under natural conditions to lay eggs at the cut end of petioles.

THE female weevil may lay as many as 832 eggs and can commence egg-laying the day after emergence from the cocoon.

THE life cycle, from egg to adult, can be completed in 87 days.

THE weevil is an enemy of other economic palms, the African oil-palm being particularly susceptible, while most dead and dying palms serve as host plants.

CONTROL measures consist in preventing injury to the palms, caused either by mechanical or other means, controlling the "Black" or "Rhinoceros" beetle, (*Oryctes rhinoceros*), and in reducing the breeding grounds by destroying dead and dying palms.

Oryctes rhinoceros, Linn., (*Dynastinae*).

(The "Black" or "Rhinoceros" Beetle).

FAN-SHAPED leaves and holes in the petioles of palms are signs of the injury caused by the "Black" or "Rhinoceros" beetle. This insect is to be feared most in districts where the "Red stripe" weevil is present, since, by "boring" the crown of the palm, suitable conditions are set up for this weevil to lay its eggs.

THE grubs may be found in accumulations of vegetable refuse, manure heaps and decaying and dead palms, so that in the control of this insect particular attention should be paid to possible breeding grounds. Systematic collection of the beetles and disinfection of the holes in the tree are methods usually adopted on estates.

Plesispa reichei, Chap., (*Hispinae*).

(The Two-coloured Coconut Leaf-beetle).

BOTH the beetle and grubs of this insect are most injurious to young coconut palms up to two or three years of age. They feed between the unopened leaflets.

THE eggs are brown in colour and are laid on the leaves. They hatch in about 7 days and the grubs feed on the leaves for about 33 days, when they change to pupae, remaining in that state for about 7 days.

THE beetles have a yellowish coloured thorax and black wing-covers: the grubs and pupae are yellowish in colour.

NURSERIES should not be made under coconut trees, but should be prepared under other trees or under artificial shade. All attacked seedlings, before transplanting or "supplying," should be immersed in a solution of lead arsenate.

AFTER transplanting, if control is still considered necessary, the insect in its several stages should be hand-collected or sprayed with lead arsenate, particular attention being paid to direct the spray towards the centre of the palm.

Artona (*Brachartona*) *catoxantha*, Hamps., (*Zygaenidae*).

THIS insect is probably present in small numbers throughout Malaya, but only comes into prominence during a sudden increase, when the damage caused by the caterpillars gives the coconut leaves the appearance of having been scorched by fire.

THE caterpillars when full grown are about ½ inch in length and have conspicuous violet longitudinal markings: the moth has brownish coloured wings and a yellow body.

THE caterpillars cause a serious reduction in yield when they are present in large numbers, but so far they have always been controlled by their

natural enemies. It is said that control has been effected by mechanical means, but the action of its parasitic and predaceous enemies was probably not sufficiently considered.

CONTROL should consist in helping the natural enemies, but the inter-relation of host, parasite and hyper-parasite is at present so little known that no definite control measures can be given without further investigation.

ALTHOUGH outbreaks have so far only occurred locally, this pest is a serious menace to the coconut industry in Malaya. A sharp watch should be kept for the caterpillars, and their presence reported immediately to the Department of Agriculture.

Setora nitens, Walk., (*Limacodidae*), and
Hidari irava, Moore, (*Hesperiidae*).

SEVERAL caterpillars feed on the leaves of the coconut palm, the above-named species being about the most prominent.

Batrachedra arenosella, Walk., (*Cosmopterygidae*).
(The "Lesser" Coconut Spike-moth).

THE caterpillars of this moth bore into the unopened spike and feed on the female and male flowers, occasionally completing their life-cycle before the spike opens.

RECENT observations indicate that other causes are also responsible for a large proportion of the fall of female flowers and immature nuts, but this insect is undoubtedly responsible for the loss of a certain proportion of nuts, and is probably the most serious pest on the coconut spike.

CONTROL measures have been worked out which effect a reduction of over 80 per cent. of female flowers attacked, but it is too early to state whether such methods would be an economic proposition.

Tirathaba sp. near *trichogramma*, Meyr., (*Pyralidae*). (The "Greater" Coconut Spike-moth).

CATERPILLARS of this moth are often found damaging and sometimes boring right into the female flowers, just after the spike has opened. They feed to a large extent on the male flowers, and especially on those which have fallen and accumulated at the base of the spike.

THE amount of damage varies, but has been considerable in some cases. Palms which are attacked should be cleaned up, and the accumulations of fallen male flowers at the base of the spikes removed and burned.

Pests of Rubber.

RUBBER is the most important crop in Malaya, but its insect enemies are remarkably few. Caterpillars such as *Acanthopsyche snelleni*, Heyl., (*Psychidae*), are occasionally found injuring the tapping surface, and others, such as *Euproctis* sp., (*Lymantriidae*), injuring the leaves but never extensively. The Termite, or "White Ant," *Coptotermes gestroi*, Wasm., is by far the most injurious pest of the rubber tree. Clean-clearing of timber, thereby destroying suitable nest logs, will result in the control of this Termite.

THE application of control measures, however, are not sufficiently practised, and there is a tendency to apply superficial and merely temporary remedies.

Objections to the employment of sound preventive measures are frequently made on account of the initial cost, but the wisest policy to follow is undoubtedly clean-clearing, since the danger from "White Ants" and fungus diseases is thus greatly reduced.

Platypus lepidus, Chap.

THIS Scolytid beetle is not a pest of healthy rubber trees, but is always ready to enter damaged trees. Rubber trees scorched by leaf fires are particularly subject to attack.

Hemithea costipunctata, Moore.

CATERPILLARS of this Geometrid moth may be found during the whole year feeding on the flowers of rubber trees. Although not at present of economic importance, this insect would reduce the yield of rubber seeds for the extraction of oil.

Pests of Padi.

RICE in Malaya, although grown sometimes on estates to provide food for the coolies, is essentially cultivated by the Malay. Several insects cause a reduction in the yield; these may be conveniently classified as (1) sucking insects, (2) boring caterpillars and (3) leaf-eating caterpillars.

(1) Sucking Insects. The most important are *Scotinophara coarctata*, ("Kutu Bruang"), and *Leptocorisa* spp., ("Pianggang"), and although others attain local significance from time to time, enquiries concerning these major pests have been more numerous.

Scotinophara coarctata, Fb.

THIS Pentatomid, called "Kutu Bruang" in Malaya, is black in colour, and about ½ inch in length. The nymphs and adults suck the sap from any part, but especially from the lower portions of the plant.

ATTENTION should be paid to the seedlings when transplanted from the nurseries, to see that all plants are free from eggs, nymphs and adults. When the irrigation water can be controlled, the padi should be flooded. Nymphs and adults rising to the surface of the water can then be collected. All stages of this insect can exist on stubble and volunteer padi growing between padi crops, so that consideration should be given to the disposal of the stubble and to the prevention of the growth of volunteer padi.

Leptocorisa spp., ("Padi Fly," "Pianggang").

THIS Coreid bug, which is probably the most serious pest of padi, sucks the sap from the developing padi grains.

THE adult is recognised by its greenish brown colour and elongate body. The eggs, which are laid on the upper surface of the leaves, are brownish in colour and very conspicuous, being laid in chain formation parallel to the mid-rib of the leaf. They hatch in about 7 days and the nymphs, in common with the adults, suck the sap. The adult condition is attained after a period of about 18 days from the hatching of the egg.

THIS insect lives on the inflorescences of several grasses until the padi begins to ripen and after the crop has been harvested, so that grasses should be

kept down as much as possible in padi areas. When the crop is growing, the insects may be reduced by collecting the eggs, nymphs and adults.

Nephotettix bipunctatus, Fb., (*Jassidae*), and *Nezara viridula*, Linn., (*Pentatomidae*).

THESE two bugs are not very serious pests, but occasionally reduce the yield of padi, the former by sucking the sap from any part of the aerial portions of the stem, and the latter by sucking the sap from the developing grain. *Nephotettix bipunctatus* is attracted to light and may be controlled by light traps. *Nezara viridula* should be collected and destroyed.

(2) "Boring" Caterpillars. The caterpillars of the Pyralids, *Siga* (*Schoenobius*) *incertellus* (*bipunctifer*), Walk., *Chilo simplex*, Butl., *Diatraea* sp., and the Noctuid, *Sesamia inferens*, Walk., are all found boring the stems of the padi plant, and cause a reduction in the yield as well as uneven ripening. Clean cultivation should be employed for the control of all these insects.

(3) Leaf-eating Caterpillars. A large variety of caterpillars included as leaf-eating are usually present, and from time to time do considerable damage.

THE caterpillars of *Parnara mathias*, Fb., (*Hesperiidae*), which roll the leaves of padi and feed inside them; of *Melanitis ismene*, Cram., (*Nymphalidae*), of *Nymphula depunctalis*, Gn., (*Pyralidae*), which are semi-aquatic; and of *Spodoptera pecten*, Gn., (*Noctuidae*), which is very sporadic and generally limited at first to a small area, all cause some damage to padi.

Control of Padi Pests. From an entomological point of view, the practice of allowing stubble and self-sown padi to grow, after harvesting the main crop, is extremely unsound. Several of the more important enemies of padi feed on wild grasses and, as long as these are allowed to grow unchecked, they provide ideal breeding grounds for insects which attack the next crop of padi.

THE eggs of the more serious insects are conspicuous on the leaves, especially of seedlings, and should be destroyed.

Pests of Cotton.

COTTON is a comparatively new crop in Malaya, and has not yet been planted on any large areas. The pests are therefore not by any means fully recorded, although those already observed indicate that the control of insects will be one of the principal factors in obtaining successful cotton crops. The wide distribution of other plants of the natural order *Malvaceae*, such as *Hibiscus* spp. and "Kapok," (*Eriodendron anfractuosum*), provides alternative food plants for a large number of cotton pests. The "Mexican" Boll-weevil, (*Anthonomus grandis*, Boh.), has not appeared in Malaya. The most important recorded pests are described below:—

Platyedra gossypiella, Saund., (*Gelechiadae*). ("The Pink Boll-worm").

THIS insect is the most dangerous pest of cotton in Malaya, although at present it is not very common. Great damage is done to the lint and seed, and the yield of both is seriously reduced. The whole larval and pupal life is passed in the boll, and the life-cycle is completed in just over a month;

hibernation may take place in the seed, although it is doubtful whether this occurs in seed grown in this country.

THE salient points in control are the creation of close seasons and the treatment of seed prior to sowing.

Earias insulana, Boisd., and *Earias fabia*, Stoll., (*Noctuidae*).

THE "Spotted Boll-worms" are present throughout Malaya. Before the bolls are formed the young shoots are "bored" by the caterpillars. Pupation takes place on the plant or in the ground.

THE bolls may be hand-picked as soon as signs of the attacks appear, but the chief control measure consists in the removal of all cotton bushes after the crop has been harvested, and in the destruction of all alternative food plants.

Heliothis obsoleta, Fb., (*Noctuidae*).

("The American Boll-worm").

THE larvae of this moth feed on a large number of plants, but cause serious injury to cotton, maize and tobacco.

LARGE numbers may be killed by the use of arsenical dusts. The removal of all alternative food plants is the best preventive.

Sylepta derogata, Fb., (*Pyralidae*).

("The Cotton Leaf-roller").

THE caterpillars of this moth roll and feed on the leaves, sometimes completely stopping the growth of the plant. By immediate attention, the attack can be stopped by the collection of the caterpillars and

by the use of arsenical dusts or sprays, but reinfection soon takes place, if alternative food plants are not destroyed.

Dysdercus cingulatus, Fb., (*Pyrrhocoridae*).
(" Cotton Stainer ").

THE boll is punctured by this insect in feeding, and bacteria are thus introduced, which discolour the lint.

THE nymphs or young forms congregate together on the bolls and on the ends of branches, and can be shaken into a bucket containing water, covered with a film of kerosene. The nymphs are particularly susceptible to *derris* (" tuba ") in spray form.

Pests of Kapok or Silk Cotton.
(*Eriodendron anfractuosum*).

KAPOK is liable to be damaged by several " boring " insects. The grubs of a species of weevil, *Alcides leeuweni*, Hllr., (*Curculionidae*), tunnel the young twigs and hinder the growth of the plant. All the damaged twigs containing the grubs should be cut off and destroyed.

Zeuzera coffeae, Nietn., (*Cossidae*).

THE caterpillars of this moth, in addition to boring the branches and stems of coffee, tea and other plants, tunnel those of kapok and occasionally do considerable damage. The caterpillars should be cut out of the stem and destroyed.

Dysdercus cingulatus, which has been mentioned as a pest of cotton and roselle, is also an enemy of this plant.

Pests of Bananas.

BANANAS are grown by Asiatics throughout Malaya, but no pest has become in any way serious.

Cosmopolites sordidus, Germ., (*Curculionidae*).

THIS is reported to be a serious pest in other countries, but has made little progress here. Damage is confined to the root and the base of the stem, in which the grubs bore.

A banana plant which looks sickly should be inspected and, if this weevil is present, the plant should be uprooted and burnt. All old stumps should be removed and destroyed and new suckers should only be planted if they are uninfected.

Erionota thrax, Linn., (*Hesperiidae*).

THE caterpillars of this "Skipper" are to be found wherever bananas are growing, living inside the strips of leaf, which they roll up into a cylinder. They do little damage and are largely kept in check by numerous parasites.

Pests of Citrus.

AT present citrus fruits are not grown on a commercial scale to any extent, and the pests have therefore received very little attention.

Orpheides malayanus, Wallace, (*Papilionidae*).

A number of Papilionid caterpillars feed on citrus leaves, but this one is most often seen. The whole life-cycle takes place on the plant.

THE caterpillars are not easy to see, and marked colour changes occur during their life. In small nurseries they are easily collected, while spraying is effective on a large scale.

Attacus atlas, Linn., (*Saturniidae*).
(The "Atlas moth").

OWING to the enormous size of the caterpillars of this moth considerable damage may be done in a short time. With careful supervision, however,

they should never be allowed to reach the full grown state, but should be collected when small, before they have been able to do much damage. The eggs, which are laid singly, are conspicuous objects and should be destroyed.

Prays citri, Mill., and *Prays endocarpa*, Meyr., (*Hyponomeutidae*).

THESE are the most destructive citrus fruit pests in Malaya at the present time.

THE minute caterpillars bore in the rind, rarely eating the fruit itself. In doing this, however, bacteria, fungi and other insects, such as the beetle *Carpophilus dimidiatus*, Fb., (*Nitidulidae*), and fruit-flies, are enabled to work havoc with the fruits.

NO satisfactory method of control has yet been worked out for this insect but, if the fruits are covered when young, they can be secured from the pest for table purposes.

Crocidomera robusta, Moore, (*Pyralidae*).

THE pomelo is subject to attacks by the caterpillars of this moth, which lays its eggs on the fruits. The caterpillars bore into the fruit and make it quite unfit for table purposes.

THE moth is not nearly as destructive as is thought, considerable confusion having arisen between the damage caused by it and that caused by *Prays endocarpa*.

POMELOES are not grown on a commercial scale, so that bagging the fruit has the desired effect.

Coccidae, ("Scale" Insects).

MANY "Scale" Insects occur, but not usually in large enough numbers to cause any serious injury. Enquiries are frequently made concerning a black

sooty mould which is seen on the upper surface of the leaves. This is not a parasitic growth, but a fungus feeding on the sugary substances excreted by "scale" and other small sucking insects. The mould interferes with photosynthesis in the leaves, and may be controlled by spraying the insects with kerosene emulsion or rosin compound.

Pests of Nipah Palm.

THE cultivation of this palm has recently been commenced on a commercial scale. The injurious enemies recorded are *Plesispa nipa*, Maulik, (*Hispinae*), and an unidentified species of crab.

BOTH the adults and grubs of the beetle feed on the surface of the leaf, and are similar in appearance to the stages of *Plesispa reichei*, Chap. The eggs of *Plesispa nipa*, however, are laid in groups, varying in number from 2 to 6. Control measures against this insect have not yet been found necessary. CRABS cause considerable damage to the young plants, especially after they have been transplanted from the nursery. In order to protect the palms at this critical period the employment of locally made appliances to protect the plants has been found effective.

Pests of Roselle.

INSECTS attacking this plant are similar to those which attack cotton, *Dysdercus cingulatus* especially being generally in evidence.

Sphaeroderma sp., (*Halticinae*).

THIS beetle, which is about ⅛ inch long and has shiny green wing-covers with a reddish coloured thorax, causes considerable damage by eating small

holes in the leaves of roselle, and spraying measures have frequently to be employed for its control.

Pests of Maize, Ragi and Sorghum.

THE pests of these plants are very similar to those of padi. Probably the worst pest of maize is *Heliothis obsoleta*, Fb., the caterpillar of which feeds on the cobs, and is best controlled by hand-picking.

Pests of African Oil-Palm and Sago Palm.

BOTH these palms are susceptible to the attacks of some of the pests of coconuts. *Rhynchophorus schach*, Oliv., probably prefers the sago palm to the coconut.

AFTER the operation of frond-pruning of African Oil-palms, all wounds should be carefully treated with some disinfectant, otherwise conditions are set up which enable this weevil to lay eggs.

Pests of Tobacco.

THE tobacco plant is attacked by several pests, of which probably the more important are the caterpillars of *Psara submarginalis*, Swinh., (*Pyralidae*), and of *Heliothis obsoleta*, Fb., (*Noctuidae*).

THE caterpillars of the former moth may be found in large numbers rolling the leaves of the tobacco plant; and those of the latter, although feeding slightly on the larger leaves, confine their attention essentially to the young shoots.

HAND-PICKING should be done but, in severe cases, spraying or dusting with lead arsenate should be adopted under supervision.

Pests of Sugar Cane.

THE most important enemies of sugar cane are "boring" caterpillars, although several sucking and leaf-eating insects have been recorded.

THE chief "boring" caterpillars in Malaya are the Pyralid, *Topeutis rhodoproctalis*, Hamps., and the Cossid, *Phragmataecia parvipunctus*, Hamps. The latter is rather interesting, since our records do not show its existence as a pest in other countries.

CONTROL measures for sugar cane pests should always be proceeded with rigorously. All eggs should be collected, "dead hearts" cut out and destroyed, and clean cultivation practised.

Pests of Tea.

THE cultivation of the tea plant in Malaya is not of great importance, but wherever the plant is grown in this country it is subject to attacks from the "borers" *Xyleborus fornicatus*, Eichh., (*Scolytidae*), *Zeuzera coffeae*, Nietn., (*Cossidae*); and leaf-eating caterpillars such as *Amsacta lactinea*, Cram., (*Arctiidae*).

Zeuzera coffeae has already been mentioned under pests of "kapok."

IF the caterpillars are abundant, spraying the plants with lead arsenate should be done under supervision.

Pests of Coffee.

ONE of the chief pests of this plant is the moth *Cephonodes hylas*, F., (*Sphingidae*), but since the caterpillars feed exposed on the leaves they are not difficult to control.

This clear-winged hawk-moth may be seen flying very quickly from one coffee plant to another and, if the leaves on which it settles are examined, small greenish eggs laid singly will be found. The eggs are generally laid on the young leaves.

Pests of Derris. ("*Tuba*").

Several species of *Derris* suffer from attacks of leaf-eating caterpillars such as *Mahasena* sp., (*Psychidae*), *Hasora alexis*, F., (*Hesperiidae*), and several others. It would appear that the toxic substances in the roots and stems of these plants are not present in the leaves and, in some species, this has been found to be the case. *Serixia* sp., (*Lamiidae*), has been found boring in the bark of *Barringtonia speciosa*, which is one of the tuba plants. It is not yet known, however, whether this plant is of any use against insects.

The plants on which pests have been found are in the experimental stage, and those finally selected for the production of insecticides may be found to be immune to insect attack.

Pests of Other Crops.

Information concerning insects attacking mango, pineapple, castor, pumpkins, gourds and other cucurbitaceous plants, brinjal, gingelly, candle-nut, ground-nut, patchouli, vanilla, cloves, nutmegs, pepper, cinnamon, ipecacuanha, cocaine, cinchona, sisal, Manila and Mauritius hemps, gambier, betel-nut, gutta percha, tapioca and other plants has also been recorded.

General Crop Pests.

A large number of caterpillars and grasshoppers do not confine themselves to any one crop, but may be found attacking many unrelated plants. Owing to

various causes, they may increase rapidly and become a serious danger. The difficulty of dealing with insects of this type is, however, nearly always increased by the fact that the cultivator fails to report their presence sufficiently early.

AMONG the caterpillars, which are very general feeders on low-growing crops, those of the following moths, (*Noctuidae*), may be mentioned:—

> *Prodenia litura*, Fb., *Spodoptera mauritia*, Boisd., *Spodoptera pecten*, Gn., *Agrotis ypsilon*, Rott.

THE caterpillars of the moths *Creatonotus* spp., (*Arctiidae*), *Euproctis* spp., (*Lymantriidae*), *Tiracola plagiata*, Walk., (*Noctuidae*), are also fairly general feeders, those of *Tiracola plagiata* being especially liable to attack plants growing adjacent to jungle.

THE control of these insects will depend on local conditions and on the particular crop attacked. In general, since these are biting insects which eat the leaves and stems, spraying with a poison such as lead arsenate is the method of control indicated.

Araecerus fasciculatus, De G., (*Anthribidae*). THIS small beetle is responsible for much damage to seeds in the field and store. The eggs are laid singly, one near each seed, which the grub destroys, later pupating inside the pod. In some cases only five per cent. of the seeds escape damage.

IN the case of growing plants a thorough pruning, to remove all ripe and unripe pods, is effective, but a distance of 500 to 1,000 yards must be left between pruned areas which have been attacked, and unpruned unattacked areas.

Hypomeces squamosus, Fb. (*Curculionidae*).

THIS weevil is very common in Malaya and, when present in large numbers, does considerable damage by eating the leaves of various plants. It is particularly bad on kapok, which is only in leaf for a short time. Breeding takes place in the soil on the roots of various grasses and cover-crops.

SPRAYING with lead arsenate causes some reduction but, should the insect be present in large numbers, the ploughing up of grass and cover-crops all round the area attacked will have to be considered.

Anomola cupripes, Hope. and *Adoretus compressus*, Weber. (*Rutelinae*).

THESE insects are night-feeding, leaf-eating beetles. As in the case of *Hypomeces squamosus*, breeding takes place in the roots of various cover-crops and grasses, and control measures are similar to those given above.

Valanga nigricornis, Burm., and *Cyrtacanthacris luteicornis*, Serv.

NUMEROUS grasshoppers, (*Acridiidae*), are always present; the two mentioned above are typical. With this class of insect it should be remembered that the young form is like the adult, only without wings, and that the young nymphs begin feeding almost as soon as they hatch out from the eggs. Control measures vary with conditions, but the use of poison sprays and baits, the spraying of grass or cover-crops where the insects congregate and the destruction of egg-masses by cultivation, where possible, are methods usually adopted.

IT has been observed that cover-crops harbour grasshoppers in large numbers, and instances have occurred where young coconut palms were only

attacked when there was a cover-crop on the ground. Adjoining areas with no cover-crop were not attacked.

Locusts. (*Acridiidae*).

LOCUSTS are grasshoppers of certain species which, from various causes, suddenly increase to incredible numbers, swarm and migrate. Except for this habit, which recurs at intervals, the locust is an ordinary grasshopper.

THERE has been one serious outbreak of locusts in Malaya. *Locusta migratoria*, L., phase *migratorioides*, Rch. and Frm., (Syn. *Pachytylus capito*, Sauss.) first appeared near a port, and this led to the belief that the locust was an imported one, which is unlikely. Although no permanent breeding grounds have been found, which are characteristic of locusts, it must be remembered that the finding of such places is extremely difficult, owing to the impenetrable nature of the forests. It is in such localities that the locust exists in small numbers, awaiting favourable conditions before again swarming and migrating.

THE measures necessary for dealing with locusts cannot be treated here, but should any indication of a migratory habit of grasshoppers be observed, the fact should be reported immediately to the Department of Agriculture.

Pests Attacking Stored Products.

IN controlling this type of insect, the chief difficulty in this country is that store-houses are rarely built in such a way as to make fumigation possible with any degree of ease. Recourse must therefore be had to other methods, which depend on circumstances.

As a preventive, rigorous cleanliness in factory and store-room will do much to prevent the increase of insects attacking stored products.

Calandra oryzae, Linn., (*Curculionidae*), is the most serious pest of stored grain, and attacks rice in Malaya. It requires 10 per cent. of moisture for development, so that, if grain can be kept bone-dry, there is no danger of attack.

Sitotroga cerealella, Ol., (*Gelechiadae*), is a moth which lays its eggs in grain, the caterpillars doing considerable damage at times.

Lasioderma serricorne, Fb., (*Ptinidae*), is a small beetle which does extensive damage to manufactured tobacco. It also attacks groceries, drugs, tapestry, silk and other articles.

Tribolium castaneum, Herbst., (*Tenebrionidae*), attacks pulses, grain, flour and such articles as rubber-seed cake.

Necrobia rufipes, Fb., (*Cleridae*), is a minor pest of dried animal products, but also feeds on stored copra. It is attracted to artificial light, and first came to the notice of the Department on account of complaints from residents living near copra stores.

Ephestia spp., (*Pyralidae*), are pests on flour and dried vegetable matter, the caterpillars making a large amount of webbing and matting the material together.

HOUSEHOLD AND OTHER INSECTS.

In addition to those attacking crops, there are certain insects against which the planter must be on his guard. House-flies, fleas, and mosquitoes are

carriers of disease, while bed-bugs and cockroaches are under suspicion. It is most important that information should be obtained concerning these insects in Malaya.

OTHER insects may seriously damage the house and its contents, the most important of which are Termites, (White Ants).

TERMITES are universal feeders, but make a speciality of wood. They work entirely under cover, shunning the light, and hence the damage is usually complete before they are discovered. They are particularly troublesome in houses, eating into the main timbers, floors, and even into the furniture. Prevention is better than cure, and houses should be constructed with a view to keeping them out.

ALL houses should be built preferably on raised masonry piles and, where the main timbers rest on these piles, a layer of iron should be placed between the masonry and the wood, since the former generally cracks and allows the insects to come up from the ground. Wood scrap from the building operations should not be left in the ground under the house, as this attracts Termites, and a periodical inspection should be made under the house to ascertain whether the runs, which the insect makes, are on the surface of the masonry. All timber used in the construction of the house should be treated with hot creosote, which preserves it for a long time against Termite attack.

IF the runs are observed on the masonry they should be traced back to the nest and a sulphur-arsenic mixture in a " White Ant Pump " should be used. It is important that every part of the house should

be accessible underneath. Bath-rooms and out-buildings should preferably be raised, and not built on the ground, as is frequently done.

In the case of temporary outbuildings, main timbers should not be sunk in the ground, but should be sunk in concrete, after being treated with creosote.

Insecticides.

The following notes give a simple method of preparation for insecticides obtainable in this country.

Arsenate of Lead. According to circumstances, from 2 to 10 lbs. of the powder may be used in 100 gallons of water. The quality obtainable at present is uncertain and burning of the leaves of plants sprayed with this solution should be watched for.

It is sometimes impossible to obtain an even spread by the use of water alone, and soap may have to be added in the proportion of 5 lbs. to 100 gallons of water. This has the effect, however, of increasing the liability to burning but, if the quality is attended to and only an *Oleic acid* soap used, this danger is reduced to a minimum.

Kerosene Emulsion. This is used for sucking insects and kills by contact, not by injestion. It consists of a mixture in the proportion of water (1 gallon), soap (½ lb.) and kerosene (2 gallons).

Dissolve the soap in the water by boiling, remove from the fire, and stir in the kerosene to make a creamy emulsion. The emulsion is readily obtained by the use of a garden syringe. Crude oil can be used instead of kerosene. For spraying, the emulsion is diluted by using 1 part in 10 to 20 parts of water.

Rosin Compound. For "scale" and other small sucking insects, rosin compound is a simple and effective insecticide. Powder 2 lbs. of rosin, and boil 1 lb. of washing soda crystals in a gallon of water. Add the powdered rosin to the boiling soda solution and keep the mixture boiling, adding more water at intervals as the liquid boils up, until the mixture turns clear, like thin coffee. This will make about 3 gallons of solution, which should be diluted in the proportion of one part to eight of water for spraying.

Tobacco Wash. One pound of tobacco stems steeped in four gallons of hot water and cooled, to which four ounces of soap is added, makes a simple wash for Thrips and other small sucking insects.

Derris. ("Tuba"). For small caterpillars and sucking insects, where a simple wash is required, the derris spray can be made on the spot, using the following proportions:—Derris root (4—5 lbs.), soap (2 lbs.), water (50 gallons).

CUT the derris root into small pieces and pound to a pulp in a mortar with a little water. Enclose the pulp in a cloth and squeeze well in a larger quantity of water. To the extract obtained by the above process add the soap, which has been dissolved in a little hot water. Then dilute to 50 gallons.

Soap Solution. This is the simplest insecticide obtainable and is quite effective for many Aphids and small sucking insects. One pound in 5 gallons of water is an average strength.

"White Ant" Fumigant. This consists of a mixture of sulphur and arsenic trioxide for use in the "White Ant Pump," and can be bought in this country ready mixed.

INSPECTION AND CONTROL OF PESTS.

In the following notes the term "pest" is used as defined in the Agricultural Pests Enactment referred to below and includes insects, invertebrate animals, rodents, plants and fungi injurious or liable to be injurious to cultivated plants.

A staff of adequately trained inspecting officers can do much to guard against the attacks of epidemic pests by enforcing control measures generally, by reporting immediately to research officers the discovery of any new pest on a crop, and by preventing the introduction of pests from foreign countries.

In the Federated Malay States and Straits Settlements such a staff exists, together with necessary legislation for the enforcement of such measures as may appear desirable to ensure effective control.

The inspection and control of pests in Malaya began in the first instance in connection with the control of two serious pests of the coconut, the rhinoceros or black beetle (*Oryctes rhinoceros*, Linn.) and the "red stripe" weevil (*Rhyncophorus schach*, Oliv.).

The rapid development of plantation rubber cultivation rendered it necessary to extend the work of inspection, and in 1913 a Chief Agricultural Inspector was appointed to organise an Inspection Division of the Department of Agriculture responsible for the control of pests on all crops in the Federated Malay States. This Division also became responsible

for pest control in the Straits Settlements in 1918 when the Department took charge of agricultural work in that Colony.

IN the early days of the newly formed Division an epidemic of an exotic species of locust required prompt attention. The control measures instituted in this instance were so effective that the pest was exterminated.

THE control of the two coconut beetle pests previously mentioned has received and is still receiving, systematic attention. Control of the various well-known rubber diseases is also a matter of routine. Pest control, in addition, includes the insistance upon a certain degree of estate sanitation in so far as the lack of such is likely to create favourable conditions for the entry and spread of disease. Estate sanitation consists mainly of the destruction by fire of dead rubber trees and the prevention of such bad and excessive tapping as will render the tapping surface liable to disease. Lalang, a coarse grass, which damages cultivated plants by weakening and retarding their growth, is considered to come under the term "pest" and its eradication is insisted upon, so far as is practicable. Complete control of this noxious weed during the recent rubber slump period was, in many instances, not economically possible, but the stricter policy which was practised before the slump, is now again followed.

ANY new line of work, or the control of any new pest, requires much instructional work among small-holders before measures to enforce action can fairly be taken. Pamphlets and posters in Asiatic

languages are issued for this purpose and field demonstrations are given. This educational work is an important function of the Inspecting Officers.

At the present time, in the Federated Malay States and Johore, pink disease and mouldy rot are the most important pests of rubber requiring constant attention, while in the Federated Malay States and the Colony much time is being devoted to experimental measures for the control of various padi pests.

Enactments and Ordinances.

In the Federated Malay States, The Agricultural Pests Enactment was passed in 1913. This empowers Inspecting Officers to enter on any agricultural land and inspect the plants growing on it. If the cultivated plants are attacked by any pest, or if the land or the plants are in a condition favourable to the introduction and/or spread of any pests, the Inspecting Officer can order the owner or occupier of the land to take such action as he may consider necessary for the treatment or control of the pest. This order is in the form of a notice stating the action to be taken and the time within which it must be completed. If the owner or occupier fails to do the work satisfactorily, the Inspector can enter the land and have the work done, after which the Secretary for Agriculture, or such other officer to whom the Secretary may have delegated powers, may authorise recovery of the cost by civil suit. For wilful neglect to comply with an order, the owner or occupier of the land can be prosecuted by the Inspector, if so authorised by the Secretary or other officer to whom the Secretary may have delegated powers, and can be fined. Inspecting Officers can thus control existing known pests of crops and

can report promptly to the research officers the appearance of new pests. Thus protection is afforded against indigenous pests. The Enactment also gives the Chief Secretary to Government power to make rules requiring the notification to Inspecting Officers of any pest likely to assume dangerous proportions. It further empowers the Chief Secretary to make rules regulating the importation of plants from outside the country, and thus affords protection from introduced pests.

IN Johore, a similar Enactment was passed in 1914. This is now replaced by a revised Enactment of 1921. In the Straits Settlements, The Agricultural Pests Ordinance No. 166 is very similar to the Federated Malay States Enactment.

THE Inspecting Officers in the Federated Malay States also administer the Water Hyacinth Enactment, No. 17 of 1917, which provides for the destruction of this noxious weed by the owner of the land on which it is growing, or in the event of his failure to do this, by an Inspecting Officer at the owner's expense.

RULES under these laws require the notification to the nearest Assistant Inspector, or to the Chief Agricultural Inspector, of the following pests:—

Brachartona catoxantha, Hamps., (Syn. *Artona catoxantha*, Hamps.), a caterpillar attacking the leaves of coconuts.

Pink Disease of Rubber (*Corticium salmonicolor*, B. and Br.).

Mouldy Rot of Rubber (*Sphaeronema* sp.).

Black Stripe of Rubber (*Phytophthora* sp.).

FURTHER rules lay down the conditions under which sugar-cane and cotton may be imported into the

Colony or the Federated Malay States; and others prohibit the importation of Para rubber, or any species of *Hevea*, except with the permission of, and under the conditions laid down by the Secretary for Agriculture or such other officer to whom the Secretary may have delegated powers.

A good deal of consideration has been given recently to the question of a more effective and systematic control of plant importation, and to the measures necessary to ensure that only healthy plants shall be exported. Rules have been submitted and will become law very shortly, making provision for the establishment of certain definite ports of entry through which alone plants may be imported. Under these rules, qualified officers will be responsible for the inspection of plants at these ports and such officers will have power to admit, require the treatment, or order the destruction of plants as they may deem necessary.

ON application for their services by intending exporters, certain Inspecting Officers of the Agricultural Department, Federated Malay States and Straits Settlements, are legally authorised to sign certificates of freedom from disease to accompany consignments of plants intended for export; such certificates being required by law in Great Britain and many other countries.

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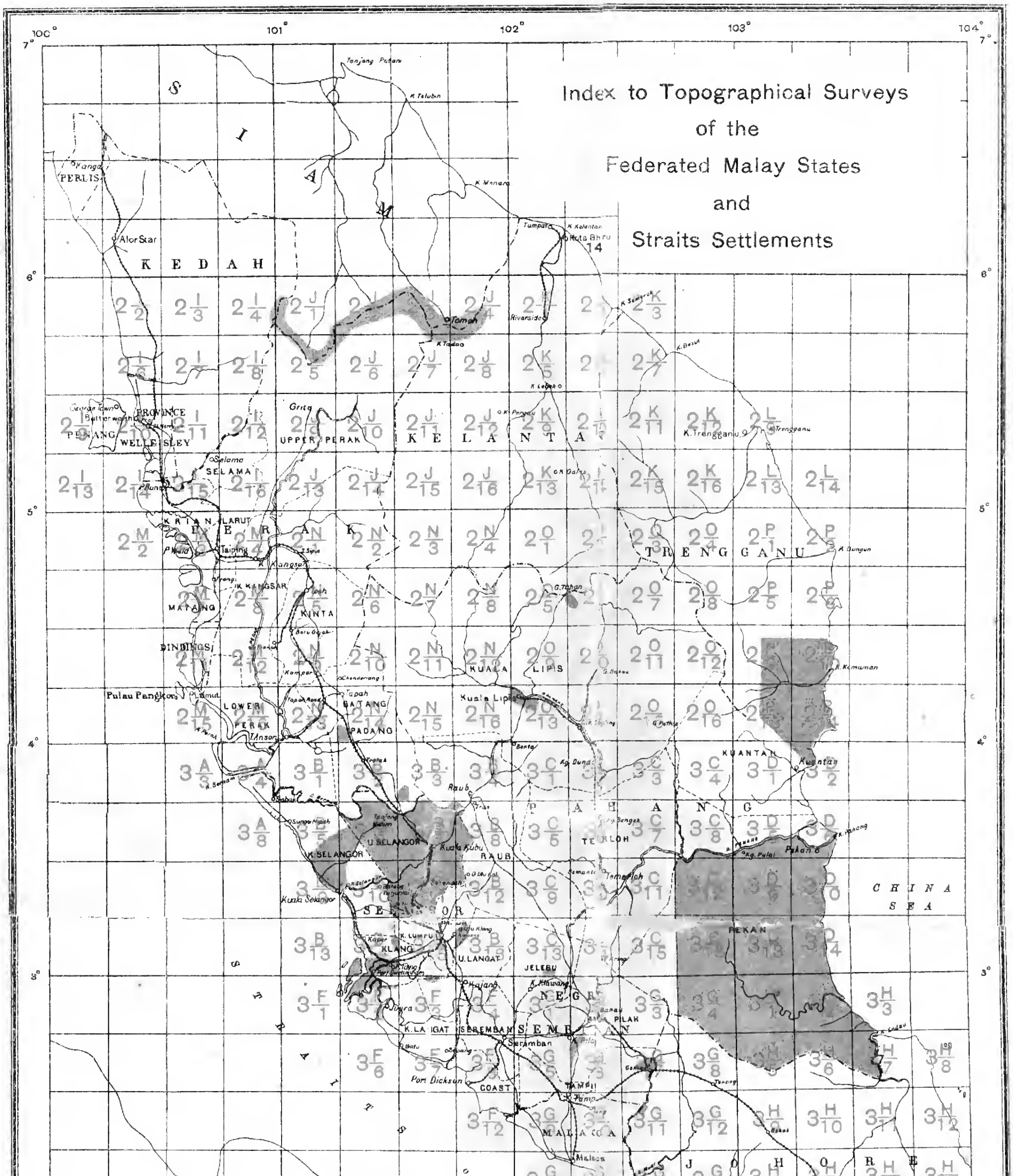

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Land Administration and Surveys.

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1. LAND LAWS AND LAND ADMINISTRATION IN THE FEDERATED MALAY STATES.

By C. W. Harrison.

Commissioner of Lands, F.M.S.

THE land administration of the Federated Malay States follows the political divisions, so that the Resident of each State administers the disposal of land belonging to the State and the collection of revenue derivable from land. In some respects the Resident refers, before decision, to the Chief Secretary.

All land in the Federated Malay States not held under title is called State land and vests in the Ruler of the State. State land may be converted into land in private ownership, called alienated land, by the Resident approving, on behalf of the Ruler, an application. Title is thereupon registered by the Government under the system known in Australia as the Torrens system; that is to say, the land is surveyed and, when the survey has ascertained its position and area, a plan is drawn and a document of title is prepared by the Government. This document is then filed and registered in the Land Office and a duplicate of it is issued to the approved applicant, who then becomes a proprietor. Transfer of ownership, raising money on land and all other

usual methods of dealing with a title to land are also registered by the Government and transactions are not effective until they have been registered.

The four States of the Federated Malay States are divided into administrative districts, of which there are twenty-four. The administrative head of each district is the District Officer. In each district there is a Land Office under the control of the District Officer and some districts are divided into sub-districts each with a Land Office. There are thirty-two Land Offices.

The only survey recognised by the Government is the survey made by the Survey Department. This department provides the survey for title, the topographical survey, and the trigonometrical survey.

The occupation, whether permanent or temporary, of land, whether for mining, for building or for agriculture is regulated by the Land Enactment, the Mining Enactment and the Registration of Title Enactment. In addition, the Malay Reservations Enactment regulates certain lands which may be held by Malays only.

Rent is payable annually to the State at the local land office on all land and there are, either set forth in the Enactments or in the documents of title, certain conditions upon which land is granted and certain restrictions and qualifications. Breach of these renders land liable to forfeiture.

A short abstract of the land laws is as follows:—

The Land Enactment 1911 was in force during 1923. It divides State land into town and village lands, country land of 100 acres in area and under, and country lands exceeding

100 acres in area, and gives the Resident power to alienate land and, with the approval of the Chief Secretary, to impose special conditions on the title. This Enactment does not apply to land for mining.

Land suitable for cultivation with wet rice can only be alienated for that cultivation.

Land alienated after 1909 carries the liability that the rent is periodically revised, the first revision being on or after the 1st of January 1940, with subsequent revisions at intervals of not less than 30 years. Revision may result in either enhancement or reduction of the rent.

It is an implied condition of all titles that the Collector of Land Revenue may re-enter upon alienated land on behalf of the Ruler of the State and forfeit it if the conditions have not been observed.

Provision is made for granting to one proprietor a right of way through the land of another.

The entire property in and control of all rivers, stream and watercourses vests solely in the Ruler of the State.

No land within fifty yards of a river, or the sea shore, can be alienated without express permission, but this does not apply to land alienated for cultivation of the nipah palm.

The Resident has power to reserve from alienation State land required for any public purpose.

The registered title vests in the proprietor only a surface right. No right to mine is granted by a title under the Land Enactment and the State consequently retains all property in minerals below the surface of land alienated under the Land Enactment.

The timber and all other jungle produce on the surface may be removed from alienated land by the proprietor, if he takes out a license and under license he may remove from his land gravel, stone, coral, shell, guano, sand, loam, clay, or anything, such as bricks or lime, manufactured from these materials. But he has the right to use all these within his own boundaries without license.

Though no right to mine is given by any title under the Land Enactment, it is possible for its proprietor to mine land which has been alienated for agricultural purposes, if the sanction of the Ruler of the State in Council is obtained and the Land Enactment title surrendered in exchange for a lease for mining land under the Mining Enactment.

Rules under the Land Enactment provide as to how application for land and payment therefor may be made, how land is to be sold at auction, what are the premium, the rent and the fees, how rice land is to be cultivated and prohibiting the planting of any specified product or the planting of such under conditions prescribed.

For the purpose of carrying out the Enactment there are a number of Collectors of

Land Revenue, Assistant Collectors, Settlement Officers and Survey Officers, as well as Malay headmen.

Provision is made for an appeal to the Court from a decision of the Collector.

Surveying and marking the boundaries of land before registering title is regulated and for subdivision of land and for surrender of alienated land to the Ruler of the State there is provision.

Land may be held under grant in perpetuity or lease for a number of years or entry in the mukim register, this last form of title being that given to small proprietors.

Boundary marks have to be maintained by the proprietor.

Rent is the first charge on all land and if it is not annually paid the land may be sold for recovery of the rent, if sale of personal possessions or crop on the land is not sufficient to realize the rent.

The Ruler of the State reserves the right of making drains, irrigation works, survey stations, laying water pipes, erecting electrical wires and of keeping these in order without paying compensation for the use of the land but compensation is allowed where improvements, building or cultivated ground are damaged.

The cultivation conditions under which land is alienated and held vary to some extent with varying areas, but the condition attaching to

a title for country land exceeding 100 acres in area may be quoted. This condition gives the right to the Ruler to re-enter on the land if commencement is not made to cultivate within 12 months from the date of the registration of the document of title or if one quarter is not cultivated within five years from the date of the registration of the document of title. In such an event uncultivated portions are resumed but even so the grantee or lessee still has the right to retain possession of two acres of land in respect of each acre under cultivation.

Penalties are provided for unlawful occupation or trespassing on State land and for unauthorised interference with public roads or waterways.

Land alienated under this Enactment may be resumed, against the will of the proprietor, for mining purposes by the Ruler of the State in Council, on payment of compensation. State land in a town or village is alienated by auction, generally. Full notice is given verbally of such auctions, but occasionally land in a town or village is approved to an applicant without auction.

Country lands are sometimes auctioned, but the more usual procedure is for the Resident to approve an application, made on the prescribed form and with a plan, to the local Collector of Land Revenue. The application will be sent to the Resident by the Collector, who will make his own recommendations and give to the Resident such information as to the applicant as he may have. It is therefore very

advisable that the applicant should be in a position to assure the Collector that he is not a mere speculator in land values. It is, in any case, almost impossible in the Federated Malay States to take up land and, without doing anything to it, to wait for a rise in value because, before this has occurred, the conditions of title will have operated and the land will have been resumed. An applicant should therefore give full information, under confidential cover if necessary, as to his financial qualifications for developing land and as to his intentions in the matter of cultivation, specifying what he intends to plant or, if he is applying for building land, what he intends to build. An applicant should be prepared to pay for his land, for his survey expenses and for expenses for registration of title forthwith on approval of the application, for no grant is issued until all the monies required have been paid and failure to pay within a reasonably short period may result in the approval of the application being cancelled.

It is usually possible, if all such monies have been paid, to get permission from the Resident to enter on the land before the grant or lease issues, if the approved applicant will agree to cut and clear his approved boundaries and will agree to keep within them and take all risk of going beyond them. He will also have to agree to comply with all the conditions which will subsequently attach to the title.

The rates of annual rent prevailing in March, 1924 were:—

RENT UNDER THE LAND ENACTMENT 1911.

The rates set out will ordinarily be the minimum rates charged but nothing precludes the Resident from at any time and without notice given altering these rates by rule under the Land Enactment 1911 or precludes the Resident from granting with the approval of the Chief Secretary special rates in case where the interests of the State may appear to him so to require.

Classification of land.	Authority.	First class.	Second class.	Both classes if cultivated with coconuts.	Both classes if cultivated with any other approved agricultural product not being rubber tapioca gambier.	Third class.	All classes.
Country land exceeding 10 acres	Land Rule 13 B (ii)	Per acre $1.00 for 6 years and $4.00 thereafter	$1.00 for 6 years and $3.00 thereafter	Rebate to $2.00	Rebate to $1.00	No third class	
Country land exceeding 10 acres	Land Rule 13, B (iii) and C.L. (C). En. 1924	Per acre $1.00 for 6 years and thereafter through 21 years rising gradually to $4.00	$1.00 for 6 years and thereafter through 16 years rising gradually to $3.00	No rebate	No rebate	No third class	
Country land not exceeding 10 acres	Land Rule 13 B (vii)	Per acre $1.20 to $3.20	$0.80	No rebate	No rebate	$0.60	
Town or village land	Land Rule 13 A (ii)						1 per cent. of the premium paid at auction-minimum $2.00 for 2,400 sq. ft. or $5.00 p.a. or $2.00 p.a.

The rates of premium prevailing in March, 1924 were:—

PREMIUM UNDER THE LAND ENACTMENT 1911.

The rates set out will ordinarily be the minimum rates charged but nothing precludes the Resident from at any time and without notice given altering these rates by rule under the Land Enactment 1911 or precludes the Resident from granting with the approval of the Chief Secretary special rates in cases where the interests of the State may appear to him so to require or precludes him from causing any State lands whatsoever to be alienated by auction.

<table>
<tr><th>Classification of land.</th><th>Authority.</th><th colspan="6">Premium per acre.</th></tr>
<tr><td>Town and village</td><td>Land Rule 13 A (i)</td><td colspan="6">Price paid at public auction or price fixed by the Resident</td></tr>
<tr><td rowspan="3">Agricultural land exceeding ten acres in area</td><td rowspan="3">Land Rule 13 B (i)</td><td colspan="6">Such premium as may be fixed by the Resident with following minima</td></tr>
<tr><td colspan="3">With road frontage</td><td colspan="3">Without road frontage</td></tr>
<tr><td colspan="3">$3.00</td><td colspan="3">$2.00</td></tr>
<tr><td rowspan="2">Agricultural land not exceeding ten acres in area</td><td rowspan="2">Land Rule 13 (vi)</td><td colspan="2">On land of the first class</td><td colspan="2">Second class</td><td colspan="2">Third class</td></tr>
<tr><td colspan="2">As fixed by the Resident</td><td colspan="2">Nil.</td><td colspan="2">Nil.</td></tr>
</table>

NOTE.—The minimum of $3.00 is rarely charged for agricultural land exceeding ten acres in area and an applicant should be prepared to pay any sum between $3.00 and $100.00 per acre, the figure being decided by the situation of the land, its soil, transport facilities and so forth.

Office fees for transactions registered in a Land Office are prescribed under the Land Enactment and range from 50 cents to $5.00.

Survey fees are also prescribed on a fixed scale and range from 5 acres and under at $25.00 to $950.00 for a lot of 1,000 acres. For each additional acre above 1,000 acres 60 cents is charged.

In addition to the survey fees, charges are also prescribed for boundary stones and iron pipes marking boundaries. The fees are $1.00 for each boundary stone emplaced and $3.50 for each pipe emplaced. Fees are also prescribed for subdivision of lands already surveyed.

Fees for redrafting plans are prescribed and range from $2.00 on a grant or lease of 100 acres and under to $10.00 on a grant or lease for over 1,000 acres.

Though land may be alienated and held under grant in perpetuity, yet this is not freehold, for the grant is issued subject to the Land Enactment and also subject to any conditions which may be set forth in the grant itself.

The acquisition for public purposes of land which has been alienated is regulated by the Land Acquisition Enactment 1922, which gives the Resident power to acquire any land whenever it is needed for a public purpose and also gives him power to

buy, with the approval of the Ruler of the State in Council, land for a residential area or a factory area or for vegetable gardens or for any person undertaking a work of public utility and also for leasing acquired land for mining. Provision is made for preliminary investigation by Government officers and declaration of intended acquisition, followed by an enquiry, held by the Collector of Land Revenue, into measurement, value and plan, after which the Collector gives an award and takes possession. The person who does not accept the award may, if the claim is more than $500, require reference to the Court, which then determines the amount of compensation to be awarded for the land acquired, according to certain principles which are set forth at length in the Enactment. Where the amount is not less than $5,000, the Court is aided by assessors but the opinion of the Court prevails upon a question of law or practice or usage and the decision of the Court prevails in case of difference of opinion as to the compensation.

The following table gives a general idea of the land available in the four States.

SUMMARY.
State of Perak.

District.	Agricultural.	Mining.	Remarks.
Kuala Kangsar	640 sq. miles not alienated much swamp and mountains.	Mining field already much worked.	
Krian	Nil.	Nil.	
Upper Perak	Nil.	Nil.	Chiefly Malay Reservation.
Lower Perak	12,000 acres available for oil palm, 20,000 for sugar cane.	Nil.	
Batang Padang	50,000 acres available.	Considerable areas available.	
Larut	Nil.	Mining field already much worked.	
Kinta	Very little available.	Rich deposits much worked.	

State of Selangor.

District.	Agricultural.	Mining.	Remarks.
Kuala Lumpur	Nil.	Rich deposits much worked.	
Kuala Selangor	Large area but swampy and no access.	Nil.	Awaits draining and communications.
Ulu Selangor	80,000 acres available.	Large area in working, and further large area waiting.	
Ulu Langat	15,000 acres available.	May be tin in this 15,000 acres available for dredging.	Awaits drainage.
Kuala Langat	44,000 acres available.	Nil.	Awaits drainage and communications.
Klang	8,900 acres available.	300 acres possibly stanniferous.	

State of Negri Sembilan.

District.	Agricultural.	Mining.	Remarks.
Seremban	Nil.	Considerable area of mining land abandoned.	
Coast	A few thousand acres available.	Nil.	
Jelebu	6,700 acres available.	Mining on the decline.	
Kuala Pilah	Large areas available.	Mining on the decline.	
Tampin	25,000 acres available.	No mining.	

State of Pahang.

District.	Agricultural.	Mining.	Remarks.
Temerloh	300 to 400 square miles available.	Mineral prospects unknown.	Railway right through district also river.
Pekan	Large areas available.	Mineral prospects unknown.	Transport difficult.
Kuantan	274,000 acres available.	35,000 acres available.	Harbour and road.
Kuala Lipis	Large area available.	Possibility of gold and tin.	Transport difficult.
Raub	Land is available.	Considerable unworked areas.	
Bentong	100,000 acres available.	Considerable worked and unworked areas with tailing difficulties.	

2. SURVEYS IN THE MALAY PENINSULA.

By V. Lowinger.

Surveyor General, F.M.S. and S.S.

The land system known as the Torrens System which has been adopted involves accurate survey so that the marks defining the boundaries of any property can be replaced if they are destroyed or removed.

In this connection the Survey Department fulfils two functions, the first, to provide the evidence on which a legally registrable instrument is based and the other to provide, for the information of everyone concerned, a record of all alienated land in the form of plans in order that the danger of alienating the same piece of land twice may be reduced to a minimum.

2. All surveys in British Malaya are based on a triangulation of first order, which is broken down into secondary triangles. Owing to the nature of the country which is covered by jungle, except where it has been cleared, the ultimate control points for the property surveys are provided by means of accurate traverses run mainly along the artificial features such as railways and roads. These traverses are closed on to Trigonometrical points and marks are emplaced at an average distance of about 10 chains (220 yards) apart. The property surveys are tied on to these traverse points and thus, not only is the actual survey checked but accumulation of error is prevented.

The property surveys are known as the "Revenue" survey, because it is on the basis of this work that the rents are assessed.

3. There is also in progress a Topographical survey. The scale of the Standard map is one inch to the mile, and other larger scales are used for special surveys, the largest being 1 chain or 66 feet to an inch for Town Planning work.

4. Topographical work is very laborious and consequently expensive owing to the nature of the country which does not allow very much sketching of detail. It is rare to be able to see details of the natural features more than ten yards away in the jungle and whenever a fixation has to be made by reference to Trigonometrical points a clearing is necessary.

5. The total area of British Malaya is approximately 55,000 square miles and up to the end of 1923, rather more than 7,000 square miles of the Standard map have been surveyed and published in addition to a good deal of work on larger scales.

6. The Department has a very efficient map producing branch and an Instrument making and repairing branch.

7. The value of Topographical surveys either in the form of the finished Standard map or of reconnaissance maps is even greater in a jungle covered country than in open country. A great deal of the preliminary work for railway or road location, for water supply and hydro electric schemes can be avoided. This is true of any type of country, but it is especially true of a country of the type of Malaya where it is necessary actually to walk over the ground in order to determine its configuration.

8. The Senior Officers of the Survey Department are Europeans, the majority of whom are licensed surveyors of Australia, New Zealand or

South Africa, but the greater part of the actual work of surveying, and most of the computing and drafting is done by Asiatics who are recruited from the local schools and trained in the department.

9. Approximately fifty per cent. of the subordinate staff are Malays who take to survey work very readily, but a long time must elapse and the facilities for technical education must be greatly improved before they will be able to aspire to the higher posts in the department.

10. In the comparatively short history of the country, however, a great deal has been done and schemes for technical education are in process of development.

11. The work of the Survey Department is an integral part of the system of land administration and the accuracy of the surveys and of the records of alienated land render the work of land administration a comparatively simple problem.

3. LAND ADMINISTRATION IN JOHORE.

By G. E. Shaw.

The small map shows the progress of map work in the Peninsula.

Until the year 1910 lands of small area in the State of Johore were occupied by Malays and Chinese under an unwritten customary law which conveyed a limited right of ownership.

According to the principles of this customary tenure the clearing of land created for the occupier a proprietary tenant right, transferable and inherit-

able. But this right remained alive only as long as certain personal services were performed, cultivation maintained and a royalty on produce paid to the State.

Personal service was generally exacted in the form of forced labour on public works, the standard of effective cultivation was a low one and the payment was a nominal one tenth of the produce. In practice the conditions of tenure were light: it was a regular practice of the local authority employing forced labour to supply food to the labourers and even sometimes, a small money payment.

Large holdings were opened as estates by Europeans, Chinese and others under leases or permits granted by the Sultan. The conditions of tenure of leasehold lands included reservation of mineral rights and certain powers affecting forest land: provision was made for re-entry on land required for public purposes and conditions for cultivation were imposed. The rent payable to the State was generally fixed at two and a half per cent. on the value of produce: no rent was fixed at a higher rate than five per cent. Rates of premia varied with the site value of the land: frequently premium was remitted altogether.

In the year 1910 soon after the appointment of Mr. Douglas Campbell as General Adviser, land legislation was introduced on the lines of the Federated Malay States Land Laws. It was not found possible to inaugurate a Survey Department on Federated Malay States lines until some ten years had elapsed. Recently the Survey Department has been staffed with a sufficient number of trained departmental surveyors and the apparatus

of land and survey administration can fairly be rated as equal in efficiency to the parallel departments in the Federated States.

The Land Enactment of 1910 was amended in 1913 by the addition of a chapter on Registration of Titles, the object being the introduction of a system of registration of title as nearly as possible resembling that of the Federated Malay States.

It was inevitable that the adoption, of the Federated Malay States Land Enactment, a code forced by particular conditions into its present shape, should fail to satisfy the requirements of a State which contained large areas of rich land already cultivated under incomplete, temporary and (often) invalid titles. Settlement, demarcation, survey and the issue of permanent titles were necessary preliminaries to the establishment of an apparatus competent to carry a land system such as that which had been built up by Johore's neighbours. Consequently in 1920 the "Settlement Enactment" was introduced for the settlement of occupied land, the establishment of boundary marks and the issue of permanent and complete instead of temporary and incomplete documents of title. As the work of settlement proceeds holdings which have not yet paid land rent to the State, except in the shape of enhanced export duty on produce, will be brought on the District rent rolls. By the issue of titles and completion of maps security of tenure will be given to old occupiers and the work of dealing with the applications of new settlers will be facilitated.

With the exception of two months in the year 1919 the Application books have been closed in respect of lands required for rubber cultivation since

February 1918 and are not yet open. Since August 1921 it has been possible to receive applications for purposes other than rubber cultivation. Such applications as may be received are dealt with promptly and every facility is given for early occupation of lands alienated. Rates of premia and rent are fixed by His Highness the Sultan in Council and vary with the site value of lands. The usual rate of rent for large agricultural holdings is $1.00 an acre a year for six years and thereafter $3.00 a year. For coconut cultivation the enhanced rate is reduced to $2.00 an acre where there is proof of actual cultivation in coconuts. In particular encouragement is given to cultivation of rice and other foodstuffs.

The total area of the State is approximately 4,800,000 acres. The total area alienated for purposes of Agriculture and Mining is approximately 820,000 acres: in addition a total area of 290,000 acres, more or less, has been set aside for Forest Reserve. In Johore owing to the absence of mountain ranges there is probably a larger percentage of plantable land than in any other State in the Peninsula.

Mining land is alienated under lease for twenty-one years, there being, of course, stringent labour conditions. The ruling rate of premium is at present $10.00 an acre and the usual rent $1.00 an acre. Export duty and the general conditions of tenure are practically identical with the Federated Malay States, from which country Johore's mining legislation has been borrowed. The area now covered by Mining Lease is 18,348 acres. The production of tin for 1922 was a little in excess of 25,000 pikuls (equivalent to 1,070 tons of smelted tin). Iron ore

is being won by a Japanese Company. This is taken entirely from surface outcrops. In the year 1922 over 111,000 tons of this ore were exported.

As stated above there is at present an embargo on the alienation of land for rubber cultivation. Applications for land required for other forms of cultivation or for mining are received at the Land Office of the District in which the land is situated. At these District Land Offices facilities may readily be obtained for the exploration and examination of State lands by intending applicants. Those who desire to acquire State lands, whether in small or in large holdings, are required to satisfy the administration that there is capital available for development.

The land administration of Johore is under the direction of a Commissioner of Lands and Mines stationed at Johore Bahru. This Officer is also Registrar of Titles for the State. He is assisted by Collectors of Land Revenue at Johore Bahru, Batu Pahat, Muar, Segamat and Mersing. The land revenue for the first eight months of 1923 was $1,506,100.

Speaking generally the Northern half of the State contains the more attractive land to rubber planters. Coconuts flourish in the flat lands on the West Coast where conditions are in all respects similar to the well-known coconut producing areas of Lower Perak.

For a new country Johore is well roaded and has a main artery for transport in the Railway. The recently completed causeway over the Tebrau Straits affords ready access to Singapore by road or rail. There is through road communication with Malacca and Negri Sembilan.

4. LAND TENURE IN KELANTAN.

By A. F. Worthington.

British Adviser, Kelantan.

"The axiom that all land fundamentally belongs to the ruler obtains in Kelantan, and though, at present, fallow land is not assessed to revenue of any kind, there is in reality no such thing as freehold landed property there. In the plains, however, where land is of high value, it is almost all held by persons who have acquired the status of landholders, that is, who have acquired heritable and alienable rights by grant or purchase from the ruler at some more or less remote period."

"Previous to the year A.H. 1299 (1881), the State kept no sort of land registers, and consequently little or nothing was known of the condition of land tenure in different districts, except to the local Headman, in whose hands lay the disposal of waste lands on behalf of the Ruler. A person desiring to take up land had to apply, in accordance with a very old established custom, to the Headman of the district, in which land in question was situated, and from him to obtain permission to occupy, on payment of a fee, which varied according to the nature of the land. The fee was supposed to be paid in to the Ruler, but was usually retained by the Headman. Having paid the fee and taken possession, the holder had done all that was considered necessary; but as title granted by the rural officials was not considered as constituting an indisputable right, he could never

be certain that his land would not at some future date be taken from him and given away elsewhere."

"In the year 1299 (1881), however, the Sultan Mulut Merah, introduced a system of registration of all changes of tenure, by which means land purchased or inherited was definitely recognised as the property of the registering party, and later on, in the year 1314 (1896), the Sultan Mansur inaugurated a Land Office, for the keeping of such registers, and for the issue of proper title deeds. A person who had acquired land by application to the local authorities was thus enabled to secure his title beyond the possibility of dispute by registering at the Land Office, and there receiving a title deed, or "Grant," as it was called, the name whence Sultan Mansur got his idea. Not content with the issue of deeds to voluntary applicants, the Sultan, in 1317 (1899), sent out a commission to enquire into the tenure of land already alienated by the State, with a view to a compulsory issue of deeds to all landholders."

The above was written by Mr. W. A. Graham, His Siamese Majesty's Resident and Adviser in Kelantan, in 1904. Later, he wrote that this commission had issued thirty thousand title deeds. A few details may be added.

Sultan Mulat Merah's regulations provided for the measurement of all land which was to be transferred or mortgaged, and for the endorsement of a plan on the deed, which was to be authenticated by two officers of the local mosque, with whom lay the duty of measurement, the local Headman, and the owners of the adjoining land. These deeds, known

locally as 'Chop' were for some years regarded as indisputable evidence of title, and the regulations of Sultan Mansur, at first, aimed only at supplying titles to those landowners who held no such deeds. For that purpose he appointed two 'Surveyors,' who dealt with the ecclesiastical parishes one by one, with the assistance of the district Headman, and the mosque officials. In cases of disputed ownership, the parties were referred first to the Courts; if there were no dispute, the new Land Office issued titles, and preserved a press copy. Later, a new form of grant was adopted, written on large size paper, a duplicate being filed in the office, and changes of ownership being endorsed on both coples.

The idea of the system was sound, but the execution was indifferent. The first difficulty was the lack of trained surveyors and accurate instruments. Sultan Mulut Merah, in the year A.H. 1299, (A.D. 1881-1882) marked a standard "Depa," or Fathom, on a large bronze cannon, which still stands near the entrance to the Palace, and measuring rods were supposed to be tested by it. This standard fathom is 5 ft. 10 ins. in length, and is said to be the measure of the extended arms of the Sultan himself. One may suspect that some rods were tested, not by the standard, but by the measurer's arms. There were no instruments to measure angles, so the survey was of the roughest, and the compilation of any map impossible. As there was then a tax on the crop, and not a fixed rent, based on the area, the inaccuracy of measurement did not affect revenue, but naturally the survey was of little use in boundary disputes. This defect has now been remedied.

The great difficulty however was that of ascertaining accurately the real ownership of the land, in a flat country, with a dense peasant population almost entirely illiterate, which for generations had acquired waste land merely by application to the local Headman, and had conducted all dealings in land by word of mouth. Further complications arose from the grant by rulers of large areas to members of the royal family or to officers of State for their maintenance. These grants were sometimes in writing, but in many cases there was considerable doubt as to their extent.

Seeing that the officials employed in the early measurement and settlement were untrained, it is scarcely a matter for surprise that, before many years passed, it was found that the old deeds could not be used as conclusive proof of ownership, and later that the issue of grants had to be stopped, pending reorganisation of the Land Office. A re-survey and resettlement were started with a trained staff, using accurate instruments, and separate Land Courts to deal with disputed cases of ownership and succession. The present highly esteemed Judge of the Land Court at Kota Bharu was appointed by Sultan Mansur as clerk when the Land Office was first opened, and has given nearly thirty years service to it. His post is no sinecure.

The present system, briefly is that of title by registration. For small holdings, which are surveyed by plane table and theodolite, the title is by entry in a register, a copy of the entry, with a plan on it, being given to the landowner. For large estates, or for town lands, grants are issued, on a theodolite survey, a duplicate being filed in the Land Office. In either case, the holder is in possession of a title

in perpetuity, subject to the payment of an annual quit rent (which may be revised after 15 years), and to certain conditions of cultivation or such special conditions as may be endorsed on the title. Alienation or transmission are subject to the law that no one, not being by birth a native of Kelantan, may acquire any interest in land, except with the permission of H.H. the Sultan in Council. This permission however is freely given in all cases where the interests of the State are not affected. No dealings in land are valid, unless registered, and on registration an endorsement of the transaction is made on the title, which thus contains a full record of all changes and permutations of ownership.

Land Rents are practically the same as in the F.M.S., but with considerable concessions to compensate for the present lack of communications, *e.g.* Premium is rarely charged on grants for large estates, but may be imposed in cases of alienation after the completion of through railway communication. Concessions are also made as to annual rent.

5. LAND ACQUISITION AND LAND LAWS KEDAH.

By H. C. Eckhardt.

Titles, for land, known as "surat putus" have been issued by the Sultan of Kedah since an early date. Originally, as the name implies, the document was the formal written decision of a Judge, recording his finding on a dispute as to ownership of land, which on being signed and sealed by the Sultan became an absolute title to land. It became customary in transferring land to obtain the signature and seal of the Judge and the countersignature and seal of the Sultan to the document evidencing the

sale. This document was also called "surat putus," in its secondary meaning of "absolute document." The next step was to obtain a "surat putus" as a protective measure apart from any dispute on transfer and finally to obtain a similar document in respect of land intended to be brought under cultivation. The "surat putus" which is the form of title now issued by the Land Office is practically a grant.

Shortly after the accession of the present Sultan to the throne, His Highness decided to create a Land Office and to collect land-tax. Two proclamations were issued in 1883 with this object. The first imposed a land-tax upon all private lands at the rate of 25 cents a relong, and any raiat who paid the tax was exempted from the liability to forced labour. The second proclamation required all persons in occupation of land in respect of which no "surat putus" had been obtained, to report the occupation to the penghulus (headmen of parishes) so that the land might be measured and documents described as "surat kechil" (little document) issued to the owner as evidence of ownership. The land-tax was thus first instituted in 1883. By a subsequent amending proclamation every raja, syed, person of good birth, haji, lebai and raiat was exempted from the payment of the land-tax. The "raiat" was included in the exemption with the obvious purpose of thrusting him back again into liability to forced labour.

The first Kedah Land Enactment bears the date 20th August, 1906. It did not however become completely operative till 1911 when forced labour was finally abolished and the liability of the raiat to pay land-tax was settled for good. Then followed the

Land Revenue Collections Enactment, the Concessions Enactment, regulations for the registration of documents, temporary occupation of land and other legislation. Finally in 1914 the Land Enactment 1332 was passed in practically its present form. This law contained little or nothing that was new in Kedah land administration, being primarily a compilation of precedents and procedure approved by the State Council at various times. Nothing was embodied in it that was in principle foreign to the custom of the State. This legislation was far from being a complete land code, but it was a great advance on pre-existing law and by consolidating the land regulations, it enabled land business to be carried on with greater expedition. Since the coming into operation of this Enactment, two amendments have been passed; one in A.H. 1337 repealed Section 15 limiting the jurisdiction of the Court, the other in A.H. 1341 repealed Section 71 limiting the rate of export duty on agricultural produce other than tapioca to 2½ per cent. ad valorem and on tapioca to 3 per cent. ad valorem. The main body of rules under the Enactment were passed in 1334 (1916) since which they have been amended in respect of rates of premia and the manner of approving applications for land.

The chief feature of the Land Enactment is the single title the "surat putus," which is in effect a grant in perpetuity, based on survey and subject to certain reservations, covenants and conditions.

The reservations are in respect of rivers, streams and waterways, mines and minerals. Beaches and foreshores are the property of the Government and there is a sixty-feet reserve along the sea-shore and banks of rivers.

The covenants are for the payment of an annual land-tax, for the maintenance of boundaries, for power of erection by Government of telegraph lines, water-pipes, ditches, etc., for the use by Government of earth, clay and other materials required for public works and for the surrender of title upon subdivision.

The conditions in respect of land exceeding 50 relongs in area are that the owner shall make a *bona fide* commencement to cultivate within twelve months from the date of title, that he shall cultivate not less than a quarter of the area within five years, that tapioca may not be grown upon the land except with the written authorization of the State Council and in accordance with the terms of such authorization. Breach of the first condition renders the title liable to cancellation. On default in respect of the second condition, the Government may resume such part of the land as is not under cultivation, provided the grantee may retain in addition to the planted area such protective jungle belts as may be necessary and an area of two relongs for every relong under cultivation. Breach of the third condition renders the grantee liable to fine at the discretion of the State Council and his title may be cancelled. Provision is made for the endorsement upon a title of a memorandum to the effect that the second condition has been complied with, and upon such endorsement no further liability attaches to the land in respect of the condition.

Land which is abandoned for three years so as to become a danger to adjoining lands may be dealt with by the Government in any manner as may seem fit.

Lands, not exceeding fifty relongs in area, if left uncultivated for two years so as to become a menace to adjacent land, may be resumed after an order to abate the menace has been made and disregarded. If land is left uncultivated for three years, the owner may be required to cultivate and if he does not do so, the land may be resumed.

The land administration is in the hands of a Director of Lands under whom are nine District Land Officers, each in charge of a district. The Director is advised by a European Officer known as the Adviser, Lands. Applications for land are lodged with the Director or a District Land Officer according as the area exceeds or does not exceed 50 relongs. The District Land Officers have no power of alienation. The Director has power to alienate land for the cultivation of padi up to 200 relongs, for kampong or orchard cultivation up to 100 relongs and for other cultivation up to 50 relongs. Applications for areas up to 500 relongs are referred for approval to a Land Alienation Board, consisting of the Adviser Lands, the Director and the District Officer of the district in which the land is situated. Applications for areas greater than 500 relongs are submitted by the Land Alienation Board to the Government. Upon approval of an application and after a rough demarcation, the applicant is permitted to enter into occupation prior to issue of title upon his signing an "akuan" (undertaking) to observe the conditions of occupation. The provisions of the law as regards the issue of permits as authority for occupation have been superseded in practice by the "akuan" system. Provisional titles known as "Surat Kechil" issue after demarcration by the Survey Office, and the

final title "surat putus" issues after survey. The conditions and obligations attaching to "Surat Kechil" are precisely the same as the conditions and obligations attaching to "Surat Putus."

The present rates of premium on alienation of land as follows:—

For padi cultivation, minimum		$ 1 a relong.
For kampong or orchard cultivation not		
exceeding 50 relongs, minimum		$ 5 ,,
exceeding 50 ,,	,,	$10 ,,
For other cultivation	,,	$10 ,,

The premium on land alienated for rubber is generally fixed at $35 a relong if the land has road frontage and $25 a relong if it has no road frontage. When land is alienated for the cultivation of such special products as may be approved by the State Council, premium is charged at the minimum rate of $10 a relong and the payment of half the premium is deferred for a term of years. In all cases, the cost of survey and boundary marks is included in the premium.

The land-tax on land under wet padi is 30 or 50 cents a relong, depending on the locality. On land cultivated with other products the land-tax is 50 cents or $1 a relong depending upon area, date of title and nature of cultivation. The Government has power to revise the land-tax on small holdings and on large holdings alienated before the 17th October, 1914 every 15 years, and to revise the land-tax on large holdings alienated after the 17th October, 1914 every 30 years. The members of the Ruling House, penghulus and other parish officials, mosque officials and a few other classes are exempt under the Land Revenue Exemptions Enactment 1332 from payment of land-tax up to a certain limit.

The payment of land-tax is enforced by the attachment of the land and the personal effects thereon and by their sale at auction.

Townships are declared and their limits defined by order of Council. The Government may compel the subdivision of road-side land into shop lots. Shop lots can only be alienated upon a "Surat-Kechil" containing a condition that a shop house of an approved type shall be erected upon the lot within the period of a year. When the condition has been complied with, a "Surat Putus" is issued in exchange for the "Surat Kechil." Upon breach of the condition, the title is liable to cancellation without notice. Land within townships is usually alienated by auction. The land-tax is $2 a lot not exceeding 2,400 square feet. The maximum land-tax on land in town limits other than shop-lots is $5 a relong.

The land policy of Kedah aims at the extinction of all old titles for land and their replacement by "Surat Putus" based on survey. All titles, whether preliminary or final, are prepared in duplicate, one copy being bound in the register, and the other issued to the owner. Transfers, transmissions, charges and other dealings with land are effected by the filing in the Land Office concerned of a properly authenticated document evidencing the transactions, and by the endorsement of a memorial thereof upon the title in duplicate. The commission on transfer is one per cent. of the sale-price up to $500 with a minimum charge of $1. If the sale-price exceeds $500, the commission is three-quarters per cent. The commission on a charge is ½ per cent. of the amount secured by the charge with a minimum of 50 cents.

The Survey Department of Kedah was established in August, 1910. The office is administered by the Superintendent of Surveys. The secondary triangulation of the State is based on the primary triangulation of the Federated Malay States. The location and charting of old alienations is done by Assistant Surveyors who demarcate the holdings as pointed out by the owners and plant granite boundary marks at the corners. The prismatic compass and chain are used in this preliminary work. After plotting and charting, a tracing of a group of holdings is sent for settlement to the Land Office, and if in order, are returned signed by a Boundary Officer and accompanied by a requisition for survey. From this work "Surat Kechil" (provisional grants) are prepared if titles are urgently required. The final surveys are then put in hand. These are done by Surveyors with theodolite or circumferentor and standardized steel bands and linked up to control traverses. Tracings are then forwarded to the Land Office for final settlement after which "sura putus" (permanent grants) are prepared. The plans are reduced and charted on the standard sheets and the maps are filed in the Survey Office.

The acquisition of land for public purposes is regulated by the Acquisition of Land for Public Purposes Enactment No. 19/31 as amended by Enactment No. 17/34. When it has been decided by the State Council to acquire any land for any public purpose, the Director of Lands draws up for the information of the Government, a report on the value of the land and the trees, crops and buildings thereon. In assessing the value he may summon one or two unofficials to assist him. If the report is

approved, a notice is served on the owner informing him of the valuation and summoning him to attend at the Land Office within fourteen days. If he accepts the valuation, his written acceptance is registered as a transfer of the land to the Government. If he is dissatisfied with the valuation, he is required to submit a written statement of claim, and the matter is referred to the Court. The Chief Judge and the European Judge sitting together hear the owner and his witnesses and the Director and his witnesses and decide upon the value, guided by the principle that the price fixed should be the fair market value of the land at the time when notice has served on the owner together with an addition of fifteen per cent. as compensation for compulsory acquisition. The decision, on registration in the Land Office, operates as a transfer of the land to the Government. There is no appeal from the decision of the Judges, but if they disagree, the matter is submitted to the State Council for decision.

6. LAND OCCUPATION IN TRENGGANU.

By J. HUMPHREYS.

British Adviser, Trengganu.

Political History. Of all the Malay States under British Protection Trengganu is the least explored and the least developed. The reasons for this are mainly political: its position on the coast of the China Sea, between Bangkok and Singapore, made it for a century the point in the Peninsula most remote from both Siamese and British influence. When a British Agent, with only Consular powers, was appointed in 1909, no trace

Note.—60 dollars = £7. 90 relongs = 64 acres.

of Siamese influence was found in Trengganu. The British Agent took no part in administration, and a purely native Malay régime continued until the year 1919, when, on amendment of Treaty, a British Adviser was appointed and the work of reform, under British advice, began.

Up to that date the visits of foreigners were viewed with disfavour and suspicion; enormous and valuable areas of the State were given out by the Sultan in Concessions to members of the Ruling House; and all foreign enterprise was hampered and hindered by the many difficulties and exactions incidental to Native Road.

Geography. 2. The area of the State is approximately 5,000 square miles. The coast line is about 140 miles in length; the greatest breadth of the country, from the China Sea to the Western boundary (on mountain ranges that separate Trengganu from Pahang and Kelantan), is about 50 miles. No less than fifteen rivers, with separate river basins, flow direct into the China Sea; and of these at least seven (the Besut, Setiu, Trengganu, Marang, Dungun, Paka, and Kemaman) give very fair access to large areas of virgin hinterland.

The coast is lighted by two first-class Port lights at the mouths of the Trengganu and Kemaman rivers, both of which are entered by steamers of 200 tons burden.

Population. 3. The population, according to the Census of 1921, was 153,765, of whom no less than 145,523 were Malays—a proportion that provides a striking contrast to every other State except Kelantan. The total European population was only 34.

The native Malay population is composed almost entirely of peasants or fishers; Kuala Trengganu is the only town (12,000 inhabitants).

Except in the Trengganu and Besut districts, where wide rice-fields are cultivated and the population has spread over considerable plains, the peasants occupy narrow strips along the river banks. The fishing population is disposed along the coast and at the river mouths. The interior of the State away from the rivers is unexplored and almost uninhabited.

Native Tenure. 4. The native population holds its land according to the ancient semi-feudal theory of Malay tenure, viz: direct from the Raja, on the three conditions of continuous cultivation, personal service of the Raja, and payment of titles of produce. Legislation is being introduced for the settlement of holdings and issue of titles on principles consistent with existing tenure.

Resumption of Concessions. 5. The Trengganu Government aided by a loan from the Straits Settlements has taken in hand the resumption of the large undeveloped Ruling House Concessions referred to in paragraph 1, with the result that the greater portion of areas distributed by the late Sultan has now reverted to the control of the Land Office. The same loan has enabled a system of trunk roads to be commenced. A European Officer was appointed Commissioner of Lands and Mines at the commencement of 1923: prompt consideration can now be given to applications for both agricultural and mining grants; and security of title can be promised to investors.

During the current year Survey has commenced and the beaconing for Major Triangulation has been completed; several important traverses have also been run. A working map of the country—much of it hitherto *terra incognita*—will soon be available.

Agricultural and Mining prospects. 6. The principal planting concern in Trengganu is the East Asiatic Company's estate of Kretai Plantations—about 12,000 acres in all. The cultivated area is approximately 4,000 acres of coconuts and 4,500 acres of rubber.

The principal tin mines (lode) are Bundi, Sungai Ayam, and Kajang, in Kemaman; there are rich wolfram mines at Chenderong (Kemaman) and Dungun. A dredging company (Malaya Tin Corporation, Ltd.) has been formed to work the Bundi alluvial land and a dredge—the first in Trengganu—is now being constructed.

The geological formations that contain the famous tin lodes of the Pahang Consolidated Company, just South of the Trengganu border, extend North into Trengganu through the Kemaman, Paka, and Dungun districts. The rich lode mines already found lie in this area, and confidence is felt that the mining possibilities of the country are great. The supposed approaching exhaustion of alluvial tin-fields in the Western States is a factor that is drawing increased attention to the untouched areas of Trengganu.

Legislation. 7. Laws, on the lines of Federated Malay States Enactments, already exist for the issue of Exclusive Prospecting Licences, Individual Mining Licences, and Mining Leases.

Prospecting Licences are issued on application to the Commissioner of Lands, and every encouragement is given to genuine prospectors. The fee for Exclusive Prospecting Licences is $5 per mensem.

As regards agricultural land an Enactment for the issue of grants, on the same conditions as prevail in the Federated Malay States, is now in course of preparation. Titles and all documents connected with land are registered in the Land Office, Kuala Trengganu, and applications are dealt with by the Commissioner of Lands.

Premium Rent, and Export Duty.

8. The terms for alienation of mining land are:—

Premium	..	$5 per acre;
Rent	..	$1 per acre per annum;
Export duty	..	10 per cent. ad valorem.

For agricultural lands exceeding ten acres in area the terms are:—

Premium (on lands with road frontage)	Special.
Premium (on lands without road frontage	$1 per acre.
Rent 50 cents per acre for 10 years, and thereafter ..	$1 per acre.
Export duty on agricultural produce	5 per cent. ad valorem.

For native holdings under ten acres in area a system of easy quitrents is being introduced.

7. LAND TENURE IN THE STRAITS SETTLEMENTS.

By the Hon. Mr. J. LORNIE.

Singapore. Land in the hands of private owners in Singapore is held direct from the Crown either by lease or grant. About a hundred years ago all land in Singapore was the property of the State and the history of the land tenure is, therefore, a reflection of the views of successive administrations regarding the best means of encouraging the permanent occupation of the land and the amount of compensation to be paid to the State for the total or partial surrender of its rights. The earliest of the existing titles are the 999-year leases issued for land in the town soon after the founding of Singapore. At the beginning of 1838 the first of the present 99-year leases for land in the town were issued, seventy-one leases bearing the date 1st January, 1838, and during the next few years they were issued in considerable numbers. The prices obtained for the early leases naturally compared unfavourably with what had been paid for 999-year leases, but there was soon a considerable improvement and the number of leases issued about the year 1842 shows that there must have been considerable demand for land throughout the town. Land in the country was only obtainable on short leases but in 1840 agriculture in the Island was in a flourishing condition and further demands arose for an improvement in the conditions on which land could be obtained from the Government. In 1842 the local Government accordingly proposed the alienation in fee simple of all land required for agricultural purposes within two miles of the limits of the town at a rate of ten rupees an acre, and

of all land situated at a greater distance from the town at five rupees an acre, the rate of ten rupees to be subject to modification by the local authorities according to circumstances. These proposals were referred to the Government of India and approved in 1843 and from 1845 onwards a large number of freehold grants were issued for land outside the limits of the town. The margin allowed for the expansion of the town was however insufficient with the result that land in the most densely crowded part of the present town is held under these titles which were originally issued for land required for agricultural purposes. The Court of Directors, who had previously left the matter to the discretion of the Government of India, took a sounder view of the matter and time has fully justified the following comment made by them on hearing of the decision: "From the map which you have now transmitted of the town and environs of Singapore it appears that the new limits within which the land is to be retained as the property of the Government coincide in most places with the present outline of the town, and that its further extension is scarcely at all provided for except on the western side. We presume that this was well considered, but we should have expected that you would have reserved at so flourishing a Settlement a more ample margin for future increase." During this period the issue of 99-year leases for town lands continued.

After the transfer to the Colonial Office in 1867 the titles issued for land both in town and country were 99-year leases and 999-year leases. Ordinance No. II of 1886 provides for a Statutory form of Crown Title—the present Statutory grant, which is a grant in perpetuity subject to a quit rent, the

form of which was simplified by the omission of various covenants and conditions previously inserted in leases, most of which are implied by virtue of the Statute. The Statutory grant has been the usual form of title issued but it has recently been decided to restrict in future the issue of Statutory grants substituting as far as possible leases for terms not exceeding 99 years.

During the last 15 years various forms of cultivation clauses have been introduced, with the object of securing the permanent cultivation of agricultural land. These are now practically of a uniform type, providing for rebates of rent during the first five of six years on the fulfilment of certain planting conditions.

At the beginning of the present century Ordinance No. 1 of 1901 now included in Ordinance 69 (Foreshores) was passed to provide a procedure for the leasing of portions of the foreshore and sea-bed for periods not exceeding one hundred years, in cases where, after a public notification for a period of three months, a declaration was made by the Governor-in-Council that the proposed leases did not create a substantial infringement of public rights.

In recent years with the rise in the value of land due to the prosperity of the rubber industry, there has been a noticeable tendency towards the formation of large estates and the disappearance of the small fruit and vegetable cultivator from many parts of the island. A change of this nature can hardly be said to be in the best interests of the Settlement, and to counteract it there has been a marked increase in the number of permits for the temporary occupa-

tion of Crown land, which are renewed year after year, and have had considerable effect in keeping the small cultivator on the land.

Penang. Land in Penang, Province Wellesley and the Dindings territory is held of the Crown, as in Singapore, by grant of lease. The conditions of tenure vary with the policy of the Government at the time the documents were issued. For many years after the founding of the Settlement the question of the land system was beset by every kind of difficulty. Mr. Light, who took formal possession of the island of Penang in the name of the Honourable East India Company, on the 12th of August, 1786, had before leaving Calcutta written to the then Governor-General as follows:—

> "People will come from Malacca, from coast Coromandel and many other places, to settle at Penang, it will be necessary to grant them a portion of land, and to establish a Police for their Security." To this enquiry he received merely the brief reply. "That will be proper." After his arrival in the island Captain Light reported that Christians, Malays and Chinese had applied for land and requested full instructions respecting the divisions of the lands. The Supreme Government in a despatch dated 22nd of January, 1787 replied. "We leave it to your discretion to receive such Colonists, as you may think it safe and advisable to admit, and to give each family such portion of land as circumstances will allow, and you may judge expedient."

Further instructions were issued on the 17th January, 1790 as to lands applied for by settlers directing their apportionment according to the

applicant's power to cultivate "by which means" it was observed, "no part of the island will in time remain uncleared." Acting on these instructions Mr. Light issued a general permission to clear and settle on the island but unfortunately no traces of the principles which regulated his distribution could afterwards be traced in the records of his administration. This was no doubt due to the fact that during the seven or eight years he was in charge of the island Mr. Light's entire official establishment consisted of one Writer. By 1823 land in the island was held on seven different tenures and Mr. W. R. Young, the Commissioner sent by the Government of India in 1831 to enquire into the land administration of the Colony, contrasts the position in Penang with the simple and intelligible titles under which land was lawfully occupied in Singapore and Malacca.

Owing to the obscurity surrounding the early distribution the introduction of a sound land system was both slow and difficult and the policy of the Government in meeting these difficulties is reflected in the present varying conditions of tenure. There are at present in Penang eleven different kinds of titles in the hands of the public as compared with eighteen in Singapore.

As in Singapore unoccupied Crown Land is obtainable on leases and Statutory grants which are also being substituted for Permits and Expired Leases. There is very little unoccupied Crown Land in the Settlement except in the Dindings. The rates of rent reserved in old leases vary in different localities. Alienation of foreshore is subject to Ordinance No. 69 (Foreshores).

Malacca. British rule in Malacca dates from 1825, the year in which the cession arranged by the treaty with the Netherlands of 1824 was carried into effect. From 1795 to 1818 Malacca had been held by the British but this was more in the nature of a military occupation than permanent civil administration. The conditions of Malacca, an ancient Malay Kingdom and then successively a Portugese and Dutch Colony, naturally differed fundamentally from those of the modern Settlements of Penang and Singapore which had no population prior to their occupations by the East India Company, and to which therefore any law of land tenure might be applied without the fear of disturbing existing rights and customs. The land tenure of Malacca as the British found it in 1825 was the native tenure of the Malays under which a tenth of the produce is due to the State and a proprietory right is created by the clearing of the land followed by continuous occupation. This tenure had remained unchanged during the Portugese and Dutch occupation. The Portugese rule was little more than a military occupation of a fortress while the Dutch though fully recognising individual rights in land neither introduced land laws nor derived any public revenue from land. The Settlement of land affairs in Malacca under British rule was retarded by the war with Naning, a small Minangkabau Colony in the hinterland, in 1831-2 and by the introduction from time to time of unsuitable regulations introduced by officials more familiar with the English practice prevailing in Singapore and Penang than with the native tenure of Malacca. The difficulty of thus attempting to combine English law and Asiatic custom was noticed by Mr. Young, the

Commissioner sent by the Government of India in 1837, who in one of his reports remarks "No one can be more fully satisfied than I am of the total inapplicability of the fictions and refinements and pedantries of English law practice to the circumstances and usages of the Straits population."

The tenure of a large part of the land in the town of Malacca remains at the present day as it was in the days of Dutch rule. Possession is evidenced in many cases by documents of title in Dutch. Land in the country is held under grant or lease from the Crown and also according to customary tenure as defined by the Malacca Lands Ordinance of 1886 now incorporated in Ordinance No. 39.

8. LAND RULES IN BRUNEI.

By L. A. ALLEN.

British Resident, Brunei.

MEMORANDUM

regarding the alienation of land and the method of application for land in the State of Brunei.

State Land.

All forest and unalienated land belongs to the State.

Documents of Title.

All alienated land is held by entry in a District Register and Extracts from District Registers are issued to holders of lands in the same way as Extracts from Mukim Registers are issued in the Federated Malay States.

Boundaries.

The boundaries of all alienated lands are surveyed or demarcated and boundary marks erected on the ground.

Transfers, Charges or Leases.

All transactions of this kind are required to be registered at the Land Office. Briefly it may be said that as regards its main provisions the Brunei Land Code is very similar to the Land Enactment in the Federated Malay States.

Applications.

Applications for land should be in writing addressed to the Officer in-charge of the Land Office, Brunei, accompanied by the prescribed fees, but any preliminary enquiries may be addressed to the British Resident, Brunei.

Map of the State.

A Map of the State showing rivers and towns in the State may be had, price $1.00, on application to the British Resident.

Fees.

Fees are payable as in the Schedule appended below—but the Government is prepared to alienate land on special terms and conditions in order to encourage the cultivation of new products or products other than rubber.

Schedule of Fees.

(One dollar = 2*s.* 4*d.*).

1. **Premium.**

(i) With a few exceptions no premium is charged at present.

(ii) If the land applied for

(*a*) contain valuable timber

or (*b*) is in the proximity of towns

or (*c*) is solely required for rubber planting

premium ranging between \$2.50 and \$5.00 per acre may be charge according to the market value of the land.

(iii) In townships the premium may be higher than stated above or lands may be alienated by auction.

2. **Rent.**

(i) This is usually 50 cents per acre for small blocks.

(ii) In the case of areas exceeding 100 acres, land has recently been alienated on the following terms as regards rent:—

50 cents per acre per annum from 1st to 6th year;

\$1 per acre per annum from 7th to 10th year;

\$2 per acre per annum from 11th to 20th year, and thereafter \$3 per acre per annum.

(iii) It is a usual condition that *bona fide* cultivation shall be commenced within a year after registration of the title and that a quarter of the land shall be brought into cultivation in the first 5 years.

(iv) In townships Rent is charged at the rate of $2.00 in respect every 2,400 square feet or less.

Demarcation Fees (including boundary marks) are charged according to area of lang *e.g.*:—

10 acres	.. ..	$10.00
25 ,,	.. ..	$21.25
50 ,,	.. ..	$46.25
For each additional acre above 50 acres	..	$ 1.25

Preparation of Title .. .. $ 1.00

MALAYAN SERIES No. XI.

LABOUR IN BRITISH MALAYA.

14/10/24

British Empire Exhibition,

London. *1924.*

Price 20 cents or 6d.

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LABOUR IN BRITISH MALAYA.

SINGAPORE:

FRASER AND NEAVE, LIMITED, PRINTERS.

1923.

Labour in British Malaya.

BY E. W. F. GILMAN.

BRITISH Malaya comprises three political groups:—

(1) The Crown Colony of the Straits Settlements, founded in the year 1867, before which the Settlements of Singapore, Penang and Malacca were part of British India.

(2) The Federated Malay States of Perak, Selangor, Negri Sembilan and Pahang, a group of protected States in the Malay Peninsula which were formed into a federation in the year 1895.

(3) The Unfederated States of Johore, Kedah, Perlis, Kelantan and Trengganu in the Peninsula and Brunei in Borneo, which have come at various times under British protection.

Their administrations are separate, but they have a common channel of communication with the Central Government through the Secretary to the High Commissioner.

The whole area of British Malaya is roughly 56,600 square miles and the total population 3,358,000 that is to say about 1/30th of the area with one hundredth part of the population of British India.

2. The development of Malaya's resources has been carried out in the main by imported labour. The amount of skilled labour employed is comparatively small and is drawn mostly from China. The chief demand is for unskilled labour—a demand which the indigenous Malay population has been quite insufficient to meet. The supply has been supplemented from three sources:—

1. India.
2. China.
3. Certain of the islands of the Malay Archipelago of which the principal are Java and Sumatra.

The third source of supply has not provided anything comparable to the number of labourers that have come to this country from India and China, but it cannot be entirely ignored in any review of Malayan labour and is probably capable if necessary of further development.

3. The three main classes of employment requiring unskilled labour are:—

1. Agricultural estates, of which rubber estates are by far the most important.
2. Tin mining.
3. Essential public services such as roads and railways.

Of these the tin mines are worked almost entirely by Chinese, the estates mostly by Indian labour though considerable numbers of Chinese, Javanese and Malays are also employed.

In the public services generally speaking, while construction work is done by Chinese the subsequent upkeep and maintenance are carried out by the Indians.

In the Unfederated Malay States where the Malay population is more dense, these essential services have been performed very largely by Malays who in those States are also employed in larger numbers on the estates.

4. Although situated so favourably in its geographical proximity to these vast sources of supply, the early history of the development of enterprise in Malaya is one of the constant difficulty in the matter of labour.

In the Report of the Commission appointed in the year 1890 to enquire into the state of labour in the Straits Settlements and Protected Native States, this fact is abundantly clear.

"The three main defects in the supply of Indian labour appear to be insufficient quantity, defective quality, and heavy cost of importation. The testimony on the subject of scarcity with its attendant evils of irregularity, crimping and desertion is almost unanimous.........." and so on throughout this Report, and so matters continued until the institution of the Indian Immigration Fund in the year 1907.

It was generally admitted that the whole system of recruiting labour from India was unsatisfactory but no ready solution presented itself.

5. It was however thought that the situation could only be permanently remedied by the settlement of a permanent labour force in the country.

Thus one of the official witnesses before the commission of 1890 states in his evidence " I certainly think it is the duty of Government to aid in procuring an adequate labour supply especially in the case of a young Colony, it should offer every inducement to facilitate a cooly labour supply and should give free passages and free grants of land to bona fide settlers."

There is a latent fallacy in this argument for it is practically impossible for a man to be a peasant proprietor and a permanent labourer on an estate or Government works at the same time—so that no settlement either of Javanese or Tamils on the land would help the situation until you reached the conditions of India and Java where the peasant population became too numerous for the land to support and the younger generation had to go out and earn a living as day labourers.

6. As far as Indian labour is concerned the problem for Malaya was solved by the institution of the Indian Immigration Fund, which has secured a constant supply of imported labour directly available for work on estates and public works.

But for the foresight which introduced this unique system before the great boom of 1910 Malaya would not have enjoyed the comparative freedon which it since has from labour difficulties and the development of the great rubber plantation industry would probably have been seriously impeded.

7. Before describing the working of the Fund as it exists to-day it will be as well to review shortly the growth and development of the Indian connection.

There has been immigration from India to Malaya from very early times and its influence is shown both in the language and customs of the Malays. But practically the emigration of Indian labour to the Malay Peninsula may be said to date from the beginning of the last century, and it originated in or was developed by the demand which sprang up with the establishment of British power on the eastern side of the Bay of Bengal.

Politically the Straits were more closely connected with Bengal but the garrison was supplied from Madras and as time went on the intercourse was increasingly with Southern India.

It was a voluntary movement and in the beginning entirely uncontrolled. But after the Straits Settlements were separated from British India for some thirty years the Government of India exercised varying measures of control over emigration.

The subject was a constant source of irritation on both sides till finally it was decided to leave the whole matter in the hands of the Colonial Government and all restrictions were removed in the year 1897. From that date for a quarter of a century emigration from India to the Straits Settlements remained free of all restrictions as far, as the Government of India was concerned, except for a short period during the war when, owing to the demands of the Imperial Government for labour battalions, emigration to Malaya was restricted to the number specified by license and males between the ages of 18 and 25 were prohibited from emigrating.

8. With the passing of the new Emigration Act of 1922, emigration to Malaya was again brought under control by the Government of India though the Act did not begin to apply until March 1923.

While this measure was under consideration very grave apprehension was felt as to its possible effect on the system which had in the meantime been built up in Malaya, and with the consent of the Government of India, a deputation went to Simla in September, 1922, to discuss the question with the Standing Committee on Emigration of the Government of India.

The depution met with a friendly reception and the conditions* and rules which were afterwards issued were so framed as to be readily adaptable to the existing system.

9. This system dates from the year 1907. In that year the Indian Immigration Committee was appointed, consisting partly of officials and partly of unofficials, with the Superintendent of Immigrants as Chairman, and an Enactment passed empowering the Committee to levy an assessment on the amount of work done by all labourers from the Madras Presidency upon employers of such labourers.

The proceeds of the assessment were to be paid into a Fund known as the Immigration Fund which was to form no part of the general revenue of the Government but to be administered by the Superintendent of Immigrants, under the authority of the Committee, solely in the interests of the importation of Indian labour.

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* The conditions are given in Appendix A.

The Government is in fact the largest single contributor to the Fund through the assessment which it pays on labour employed in the Railways, Public Works and other Government Departments.

The special Enactment under which this system was introduced has since been incorporated in the general Labour Code and the officer administering it is now known as the Controller of Labour.

10. The purposes for which the Fund can be used are carefully defined and include, besides expenses connected with the importation of labour, "the maintenance of homes for decrepit and unemployed Indian labourers and the children and orphans of Indian labourers," and "repatriation of and assistance to Indian labourers in need of relief."

Two such Homes exist. One at Kuala Lumpur for decrepit labourers has been in existence since 1914. During the past year an Institution has been started in Penang where unemployed labourers are housed and fed until work is found for them. Except in times of acute trade depression such as we have recently passed through there is little unemployment and the numbers entering these Institutions are very small.

11. Until quite recently most of the expenses of administering the Fund were borne by the Government, which also paid the salaries of officials in India, maintained the Emigration Camps there and paid the annual subsidy to the British India Steam Navigation Company, whose steamers are under contract to carry the emigrants.

From the Fund were paid the general expenses of recruiting, the principal items being trainfare of emigrants from their homes to the ports of Negapatam and Madras and their feeding in the Emigration Camps at these places while awaiting shipment, passages from Madras or Negapatam to the Straits, the expenses of quarantine on arrival at Penang, Port Swettenham or Singapore, transport thence to their places of employment in Malaya and the payment of recruiting allowances to the employers by whose Agents they had been recruited.

These Agents known as Kanganies are sent over by individual employers to recruit for their particular places of employment and receive remuneration in the form of commission from these employers. The recruiting allowance paid to the employer is intended to recoup him for this expenditure and other incidental costs not met from the Fund.

During the past year the financial relations between Government and the Fund have been revised and the expenses of administration, the steamer subsidy, the maintenance of the Emigration Camps and all expenditure that can be considered to come under the head of recruitment as distinguished from "protection" have been transferred to the Fund.

12. The kangany or agent who recruits must fulfil the following conditions before he can obtain a license:—

i. he must be an Indian of the labouring classes.

ii. he must have been employed as a labourer on the place of employment for which he intends to recruit for a period of not less than three months.

Licenses are issued by the Deputy Controller of Labour in Penang and under the new regulations are endorsed by the Agent of the Government of India. The number of labourers each kangany is authorised to recruit is limited in the first instance to twenty—the maximum commission is limited to Rs. 10/- per head for each labourer recruited.

On arrival in India the kangany takes his license for registration to the office of the Malayan Emigration Commissioner in Madras, an officer of the Malayan Civil Service appointed by the Malayan Governments with the approval of the Government of India to supervise emigration to this country, or in Negapatam to the office of the Assistant Emigration Commissioner. Only on endorsement by one or other of these officials does the license become valid. The period of currency of the license is usually for six months and is limited to one year.

After having his license registered the usual routine is for the kangany to proceed to the offices of Messrs. Binny & Co., Madras, or Messrs. Madura Company, Negapatam. These firms are the British India Steam Navigation Company's Agents and generally act as financial agents in India for employers in Malaya.

There is no obligation to employ either of these firms and at various times other arrangements have been made by individual employers, but in practice the two firms enjoy a virtual monopoly.

After receiving an advance (usually about Rs. 20/-) from the financial agents the kangany proceeds to his own village and there informs his friends and relations of the conditions of labour on his estate.

When the kangany finds people willing to emigrate he must supply them with a copy of the official pamphlet* giving information about Malaya and obtain their receipt for it. He must then produce them before the Village Munsiff or Headman whose duty it is to see that there is no valid objection to the person emigrating. If satisfied the Village Headman initials the entry of the intending emigrant's name on the back of the license. When the kangany has collected a number of intending emigrants and obtained the necessary authorisation from the Village Headman he takes them to the port of embarkation, i.e., Madras or Negapatam, either himself prepaying the trainfare, which he afterwards recovers, or getting the fares paid by one of the Recruiting Inspectors or Agents (of whom there are fourteen) employed by the Fund.

Before they are permitted to embark all emigrants are inspected by the officials of the Indian Government—the Protector of Emigrants and the Medical Inspector.

After the emigrants are shipped, unless he is himself returning to the Straits when he is paid the balance due to him on arrival, the kangany receives his commission less the amount of his advance from the financial agents.

The commission of Rs. 10/– is sufficient to cover all legitimate charges and is kept purposely low to prevent the kangany from dealing with professional recruiters.

The recruiting allowance which the employer receives from the Fund has varied from $3/– to $20/– and it at present fixed at $10/– the latter figure is designed

*A copy of the pamphlet is attached, Appendix B.

to cover all legitimate out of pocket expenses with just sufficient margin to induce employers to recruit up to their own requirements.

13. Besides the emigrants recruited by kanganies for individual employers any bona fide agricultural labourer who is physically fit, on application to the Emigration Commissioner or his Assistant, can obtain a free passage to Malaya at the expense of the Fund, without incurring any obligation to labour for any particular employer on arrival.

The number of these voluntary emigrants has been steadily increasing. They are for the most part returning emigrants who are proceeding to their old places of employment and as they are not recruited neither kangany's commission nor recruiting allowance is payable.

14. Attached to this pamphlet as Appendix C will be found a copy of the balance sheet of the Fund for the half year ending 30th September, 1923. It will be seen that this discloses a very satisfactory position—there being a credit balance of $1,878,431.00 practically all in liquid assets.

In view of the uncertainty as to the probable number of immigrants estimates are difficult to frame but on the basis of 40,000 assisted immigrants being imported in 1924 the estimated expenditure including all administration charges and contingent liabilities is $1,502,106.00. That is to say with all overhead charges the cost of importation works out at less than $38/– per head, none of which falls on the individual employer except in the form of assessment.

The assessment at the present rate of \$2/– per quarter per unit of 78 days' work is equivalent from the employer's point of view to an addition of 2½ cents a day to wages of all Indian labourers he employs.

15. In comparison with these figures it should be noted that the cost in 1922 of introducing Javanese labourers under indenture was \$92.50 and in the preceding year no less than \$141/– per head.

But whereas the Indian labourer is landed free of debt and is free to leave his employer at any time on giving a month's notice the Javanese labourer introduced under a contract of service is bound for a period of 900 days and has to repay half of his "allowances" i.e., usually about \$6 out of \$12 which he receives in cash.

16. The operations of the Indian Immigration Fund which at first embraced only the Straits Settlements, Federated Malay States and Johore now extend to the whole of British Malaya, except the States of Trengganu and Brunei, which have not yet sought admission.

17. For the purposes of the Fund the term Indian labourer applies only to natives of the Madras Presidency or the adjoining Native States, i.e., Tamil, Telugu and Malayalee labourers with a few Uriyas from the north of the Presidency. The bulk of them are Tamils—out of 258,000 Indians enumerated on 1,350 estates in the whole of Malaya at the census of 1921, 208,000 were of this race.

The majority of these imigrants make but a short stay in Malaya and any increase in the number of arrivals in one year will be reflected in the number of

departures in the following years. The average stay of an Estate labourer is from two to three years and in order to maintain the labour force at its existing level it is necessary to recruit some 35 per cent. annually. During the decade 1911 to 1920 the total number of immigrants from Southern India was 908,100 of whom 714,175 were assisted immigrants brought in by the Fund.

The number returning to Southern India during the same period was 561,913. The highest figure for the number of arrivals was reached in 1913 when the total was 118,583. The outbreak of war naturally had a disturbing effect but this was of short duration. The number of arrivals which fell to 51,217 in 1914 rose again the following year to 75,323.

The trade depression which began at the end of 1920 reacted immediately on the flow of Indian Immigration. In 1921 the number of arrivals fell from 95,220 in 1920 to 45,673 while the departures rose from 55,481 to 61,551.

In 1922 the figures were arrivals 58,674 and departures 45,733.

To the end of November, 1923 arrivals numbered 43,671 and departures 39,776.

The falling off in the number of arivals in 1923 was due in part to a decline in the demand for labour during the early months of the year following on the introduction of restriction of rubber exports, but the uncertainty attending the introduction of the new Rules under the Indian Emigration Act also affected the position. Many employers purposely delayed sending Kanganies to India pending the introduction of the new regulations.

18. In describing the institution of the Indian Immigration Fund reference has been made to the office of the Controller of Labour. This official is ex-officio Chairman of the Indian Immigration Committee and as such administers the Indian Immigration Fund. The Labour Department of which he is head exists for the protection of labourers of all classes on estates and other places of employment.

Before the consolidation of the labour laws which was first effected in the Federated Malay States by the Labour Code, 1912, and in the Colony by the Labour Ordinance, 1920, separate Enactments existed for the protection of Chinese, Indian and Netherlands Indian (Javanese) labourers.

The Indian Immigration Departments of the Straits Settlements and Federated Malay States had been combined at the time of the institution of the Indian Immigration Committee in 1907 and with the passing of the Netherlands Indian Labourers' Protection Enactments in the Colony in 1908 and Federated Malay States in 1909—the supervision of this class of labour was entrusted to the same Department. On the introduction of the Labour Code the Labour Department in its present form was constituted.

It absorbed and took over the duties of the old Indian Immigration Department, while officers of the Chinese Protectorate were appointed Deputy or Assistant Controllers of Labour to deal with questions of Chinese labour. Practically the Chinese branch is quite distinct and is administered by the Secretary for Chinese Affairs as part of the Protectorate, but in

dealing with labour matters these officers exercise their powers under the Labour Code and are required to keep in touch with the Controller.

The head-quarters of the Controller are at Kuala Lumpur. The Deputy Controller at Penang is Secretary and Treasurer of the Indian Immigration Fund and the bulk of the business connected with Indian Immigration is conducted in that office. There are sub-offices of the Department at Kuala Lumpur, Klang, Port Swettenham, Seremban and Singapore.

19. In the year 1910 a separate Health Branch of the Government Medical Department was formed in the Federated Malay States primarily to deal with the health of the labourers on estates and a special Enactment known as the Estate Labourers' (Protection of Health) Enactment was introduced. This was likewise incorporated in the Labour Code, and later on the similar Ordinance in the Colony was embodied in the Labour Ordinance, 1920.

Orders in matters affecting health and sanitation on estates are issued by the Controller of Labour who is advised by the Health Officer.

The provisions to be made for labourers on an estate by an employer are summarised in Section 162 of the Labour Code 1923 as follows:—

(*a*) sufficient and proper house accommodation.
(*b*) a sufficient supply of wholesome water.
(*c*) sufficient and proper sanitary arrangements.
(*d*) hospital accommodation and equipment.
(*e*) medical attendance and treatment including diets in hospital.
(*f*) a sufficient supply of medicines of good quality.

Owing to the less permanent nature of the employment, the provisions for mines are more general but the accommodation must fulfil all reasonable sanitary requirements and sick labourers must be sent to the nearest Government Hospital.

20. In the course of the negotiations with the Government of India in connection with the Emigration act of 1922 various amendments of the Labour laws in this country were decided on, many of them of an important character.

The Code in the Federated Malay States had already been amended no less than twelve times and a complete revision of both the Straits Settlements and Federated Malay States laws was accordingly put in hand. The new Enactments were passed in July, 1923, and came into force on 1st October, 1923. Similar action is being taken in the Unfederated Malay States and new Codes are already in draft for the States of Johore, Kedah and Brunei.

The principal changes introduced by the new Code are:—

(1) The abolition of fines for labour offences. Imprisonment having already been abolished, the contract between employer and labourer becomes a purely civil one, except in the case of subsisting contracts of Javanese labourers and certain "constructive" contracts of Chinese Labourers on Mines.

(2) The power to compel employers to provide schools for labourers' children.

(3) The provision for payment of maternity allowances to female labourers.

(4) The introduction of the principle of a standard wage in the case of Indian Labourers.

The text of Section 141, Labour Code, Federated Malay States, containing the provisions relating to standard rates of wages is given in Appendix D. No penalty attaches to noncompliance with any notification made under this section but sanction is provided by the power of the Committee to refuse free passages and other benefits of the Fund.

21. With the repeal and reenactment in a consolidated form of the various enactments relating to labour it has been found necessary to retain the separate Netherlands Indian Labourers Protection Enactment. The reason for this is that in the case of this class of labour alone the indentured system still survives.

The control exercised by the Indian Immigration Department and the Chinese Protectorate in the case of Indian and Chinese labourers respectively was instituted for the protection of labourers under indenture.

The indentured system in the case of Indians was abolished in 1910 and for Chinese in 1914.

As long ago as 1890, as we see from the Report of the Labour Commission of that year, the possibility of developing Javanese immigration was being seriously considered. Thus "Java is a source from which our labour supply might be much augmented. Just as in India, there appear to be large numbers of men in indigent circumstances, whose emigration could only be a benefit to themselves and to their country, and who would be ready to come over were they given facilities."

It was not till nearly twenty years later that the special enactments for the protection of Netherlands Indian indentured Labourers were introduced, after protracted negotiations with the Netherlands Indian Government, and their introduction very shortly preceded the abolition of indenture in the case of other forms of immigrant labour.

22. Two causes have prevented any great development of this form of labour immigration:—

i. The high cost of recruitment.

ii. The success which attended the Immigration of free labour from India under the Immigration Fund System.

In the Federated Malay States at the end of 1922 the total number of Netherlands Indian Labourers on estates was 4,922, a decrease of 800 from the preceding year. Of these only 1,203 were still under indenture (contract of service).

On estates in the Colony there were 2,340 of these labourers, none of them under indenture.

23. Although the organised introduction of Netherlands Indian Labourers has not been attended by any great measure of success there has been a steady influx of voluntary settlers along the whole of the West coast of the Peninsula. Some 60,000 acres of land have been given out in small holdings to Javanese settlers in Lower Perak and similar large areas in Northern Johore and other parts. But this kind of immigration only indirectly affects the supply of labour available for the large estates and public works.

24. In its origin immigration from China to the Straits was, like that from India, purely voluntary and unassisted and, like that from India, for a long time was carried on without any supervision by Government.

But that the question of protection of these immigrants was very early considered is shown by the following extract from an Ordinance of the 1st May, 1823, published by Sir Stamford Raffles:—

> "As it frequently happens that free labourers and others are brought from China and elsewhere as passengers, who have not the means of paying for their passage, and under the expectation that individuals resident in Singapore will advance the amount of it on condition of receiving the services of the parties for a limited period in compensation thereof—such arrangements are not deemed objectionable provided the parties are landed as free persons, but in all cases the amount of passage money or otherwise is limited to twenty dollars, and the period of service by an adult in compensation thereof shall in no case exceed two years, and every such engagement shall be entered into with the free consent of the parties in presence of a Magistrate, and duly registered."

This Ordinance apparently dropped out of notice and nothing is heard of the subject till the seventies. References to immigration appear from time to time in the Journal of the Indian Archipelago but nowhere is the existence of any form of control mentioned. After considerable opposition, the Chinese Immigrants Ordinance of 1873 was passed but never brought into force.

Following the report of a Commission appointed in 1876 a second Chinese Immigration Ordinance No. II of 1877 was passed and became law and from it dates the origin of the Chinese Protectorate, which was established in 1880.

25. In the Report of the Labour Commission of 1890 the system as it then existed is thus described:—

> " Speaking generally, all Chinese immigration is conducted on the same system, that is to say, a recruiter or agent pays the passage and expenses of the intending emigrant, in some cases giving him a small advance as well, on condition that the cooly ultimately works off by his labour the expenses so incurred. Usually the Chinese agent recovers his outlay, plus a profit, from an agent or broker in Singapore or Penang, to whom the cooly is consigned, and who remits the necessary sum to China on receipt of the cooly. This second agent then disposes of his cooly to the employer or his agent, making the best terms he can, according to the state of the market, to recoup his outlay and secure himself a profit.
>
> On arrival in Singapore, the cooly, after being inspected on board ship by an officer of the Chinese Protectorate, is taken by the broker to whom he is consigned to a licensed depot where he is to be lodged until he finds employment. The broker always has orders on hand from the agents of the various employers in Sumatra and elsewhere, and when coolies arrive, he informs these agents and arranges a price at which he will deliver the required coolies on board a steamer sailing for their destination. The representative

of the agents, accompanied by a doctor, then visits the depot and selects such coolies as appear suitable, receiving a photograph in duplicate of each man so selected, one copy of which he forwards to the Protector of Chinese, keeping the other for his own use. The broker, on the day of sailing if possible, takes the selected coolies to the Protectorate, where they are identified by the photographs received from the agents, and the contracts are signed. At the same time the coolies are paid whatever advances they have to receive, in the presence of the Protector. The contracts are between the agents and the coolies, the broker's name nowhere appearing. One general contract in English is signed by the agents, the Protector and all the coolies, and in addition each cooly receives a Chinese translation of this, also stamped by the agents and signed by an Officer of the Protectorate. The coolies are then taken on board the ship, and the agent's representative comes on board at the time of sailing and checks them by the photographs. The agents take no responsibility for the safeguarding of the coolies, who remain in charge of the broker until they are taken over by the employer or his representative. The point at which the broker's responsibility ceases varies. Coolies for Borneo are generally handed over to the employer or his agent before the departure of the ship, but those for Sumatra are, as a rule, delivered by the broker on the estates. Coolies for Pahang are taken over on the ship's arrival at the port of disembarkation, and other practices prevail on the various other lines of traffic."

The Sin-Kheh (Chinese, "New hand") system as above described lasted with little modification till the abolition of indenture at the end of 1914.

26. Chinese coolie immigration is still conducted on more or less the same lines that is of passages assisted by private enterprise—and under the Labour Oode the "indebted immigrant," is still liable to repay his "creditor" the amount of passage money and "advances," but there is power to limit these by law, and the liability for repayment is a civil one. It is only fair to state that this liability is seldom repudiated.

27. The average number of Chinese immigrants who arrived in Singapore annually during the decade 1911 to 1920 was 160,000 as compared with an average of 90,000 arrivals per annum in Penang from Southern India during the same period.

Complete figures for the number of departures of Chinese deck passengers from Singapore are not available but for the five years ending 1920 they averaged 49,000 as compared with an average of 56,000 departures from Penang to Southern India.

The highest figure for the number of arrivals from China was reached in 1911 when 269,854 landed in Singapore and the total in each of the two succeeding years exceeded 240,000. After the outbreak of war the numbers fluctuated considerably and fell to 58,000 in 1918.

The numbers were not affected in the same way as those from India by the trade depression for the arrivals rose from 126,000 in 1920 to 191,000 in 1921.

Arrivals in 1922 were 132,886 and departures 96.869 and for the first nine months of 1923 the figures of arrivals are 118,000 and departures 55,000.

Practically all immigrants for Malaya come from South China from Kwang Tung, Kwang Sai and the Hokkien provinces and from the island of Hainan.

Although the total volume of this immigration exceeds that from Southern India it includes comparatively few labourers directly recruited for estates.

28. Long before the institution of the Immigration Fund, the Straits Settlements Government had assisted immigration from India by the grant of a shipping subsidy and by opening a depot in Negapatam. The first shipping subsidy was given in 1887 and the depot was opened in 1890.

No such assistance has ever been given in the case of Chinese Immigration.

In view of the success which has attended the Indian Immigration system the possibility is naturally suggested of its extension to other forms of Immigrant Labour.

The General Labour Committee which was formed by the Planters' Association of Malaya in 1920, appointed a Special Committee "to consider and recommend means for increasing the number of Chinese Labourers in British Malaya."

The Report issued by this Committee contained an exhaustive account of the efforts made from the year 1910 onwards to place the recruitment of Chinese Labour on a more satisfactory footing. It recommended the formation of a General Labour Board for the Malay Peninsula to regulate and control the recruiting of all classes of immigrant labour, i.e. Indian and Javanese as well as Chinese. While this recommendation was not accepted the Governments concerned agreed to the formation of an Advisory

Committee to consider the question of the importation of Chinese labour, its scope to be limited to the States of Negri Sembilan and Johore and the Settlement of Malacca. It was from the two States and Settlement named that the demand for a scheme to control Chinese labour immigration had mainly come and it was felt that while there was little likelihood of reaching any agreement upon a scheme over a more extended area there was at least a chance that a limited scheme might succeed. The Committee has been constituted with the Controller of Labour as Chairman but has not as yet formulated any definite scheme and, as far as present requirements are concerned, the need does not seem to be pressing.

29. Generally the position with regard to the supply of labour may be viewed with some satisfaction. While there is practically no unemployment the supply is ample for the existing demand.

More economical methods of working and the introduction of labour saving devices both in rubber planting and in tin mining have resulted in a great reduction in the number of labourers employed by these industries.

In 1913 the total labour force employed in mining in the Federated Malay States was 225,405 having risen fairly steadily from 150,000 in 1900.

In 1922 the total number of labourers on mines was 82,195 of whom 76,449 were Chinese. A similar, though not so extensive, reduction has been effected more recently in Estate labour.

At the end of 1919 the labour force on estates in the Federated Malay States from which returns were collected by the Labour Department was 237,134 of

whom 160,658 were Indians and 61,089 Chinese. At the end of 1922 the total was 167,259 of whom Indians numbered 130,190 and Chinese 27,829.

Current figures for the whole of Malaya are not available, but at the end of 1918 the total labour force on estates over 100 acres was given as follows:—

Indians	..	210,028
Chinese	..	101,345
Malays	..	31,389
Javanese	..	21,538
Others	..	4,264
Total	..	368,564

The corresponding total at the end of 1922 probably did not much exceed 300,000 of whom 190,000 were Indians.

The number of labourers employed by Government Departments in the Federated Malay States which rose to 30,000 in 1920 is now about 20,000, practically the same as in 1918, and of these the greater number, viz., 18,500 are Indians.

The number employed by Public Departments in the Colony is about 13,000 of whom 8,000 are Indians, and 4,000 Chinese.

30. Stability of the supply of labour has naturally conduced to a steady level of wages. Wages inevitably fluctuate with times of prosperity and depression but these fluctuations have been kept in check in Malaya by the nature of the labour supply.

The actual rate of wages varies according to the locality, the class of labour and the nature of the work.

Chinese labourers on estates are mostly empolyed on contract work, Indians and Javanese on daily wages. The standard of wages for Chinese is higher than for the others. The relative value of their labour is a matter of opinion but obviously when Chinese receive higher wages it is because their employers consider their services more valuable.

One reason why Chinese command higher wages is the competition for their labour by other forms of more arduous employment to which Indians and Javanese are not attracted.

It is difficult to arrive at an estimate of the average earning of Chinese estate labourers at the present times as conditions are still abonormal but $15/– to $18/– per mensem may be taken as a rough approximation.

In the Federated Malay States the prevailing rates of wages for Indian labourers are 40 cents for men and 30 cents for women and similar rates obtain for Javanese. Lower rates are paid to Indians in the coast districts of Selangor where wages of men range from 27 to 35 cents a day and for women from 22 to 30.*

On the mines the Chinese work largely on a profit sharing basis and their earnings vary with the price received for the ore. In times of prosperity they can earn very much more than as agricultural labourers and as soon as the price of tin rises labour is attracted from the estates to the mines.

* At a meeting held on 9th February, 1924, the Indian Immigration Committee acting under Section 141 of the Labour Code (cf. Appendix D.) have subject to the approval of the Chief Secretary to Government fixed standard rates of wages in the Kuala Selangor District at 35 cents for men and 27 cents for women.

31. In this necessarily brief review the subject of labour has been regarded from the standpoint of the employer rather than of the labourer but it will be apparent from various references throughout the pamphlet that the well-being of the labourer of every race has been the constant care of the Malayan Governments. The majority of immigrants come to earn a livelihood, save a little money and return to their native land, rather than with any idea of settling. In the countries from which they come, in India as well as in China, there exists a strong prejudice against emigration. That notwithstanding so many have been found to emigrate to Malaya is proof of the attraction that this country holds for the emigrant.

APPENDIX A.

No. 152—The following notifications of the Government of India are published.

DEPARTMENT OF REVENUE AND AGRICULTURE.

EMIGRATION.

Delhi, the 17th February, 1923.

No. 137—Emi.—In exercise of the powers conferred by section 10 of the Indian Emigration Act, 1922 (VII of 1922), hereinafter referred to as "the Act," the Governor General in Council is pleased to issue the following notification in the form in which it has been approved by both Chambers of the Indian Legislature:—

Emigration to the Straits Settlements, the Federated Malay States of Perak, Selangor, Negri Sembilan and Pahang and to the Unfederated Malay States of Kedah, Perlis, Johore, Kelantan, Trengganu and Brunei for the purpose of unskilled work shall be lawful on the following terms and conditions, namely:—

(1) The emigrant shall—

(*a*) have been recruited by a person licensed for that purpose by and responsible to an officer (hereinafter called the Emigration Commissioner) appointed by the Government of the Straits Settlements and by the Governments of the Federated and Unfederated Malay States, or

(*b*) have applied direct to the Emigration Commissioner for an assisted passage and have been accepted by him.

(2) The emigrant shall not before leaving British India, have entered into any engagement to labour for a period exceeding one month.

(3) Engagements to labour entered into by an emigrant in Malaya for a period exceeding one month shall be void.

(4) The Government / Governments of the Straits Settlements / Federated & Unfederated Malay States shall at any time when so desired by the Governor General in Council admit and give all facilities to an Agent appointed under section 7 of the Act.

(5) Within one year of his arrival in the Colony any emigrant who has been assisted to emigrate at the cost of the Indian Immi-

gration Fund shall, on satisfying the Agent appointed under section 7 of the Act that his return to his home is desirable either on the ground of the state of his health or on the ground that the work which he is required to do is unsuitable to his capacity, or that he has been unjustly treated by his employer or for any other sufficient reason, be repatriated free of cost to the place of recruitment and the costs of such repatriation shall be defrayed by the Government of the Straits Settlements / Federated and Unfederated Malay States.

(6) If at any time there is no Agent appointed under section 7 of the Act, the Government / Governments of the Straits Settlements / Federated & Unfederated Malay States shall appoint a person to perform the duties of the Agent as set forth in clause (5).

(7) There shall be no evasion of the provisions of the Act by the conveyance through foreign ports in the Peninsula of India of persons who would be emigrants for the purpose of unskilled work if they departed from British ports.

(8) The Government of the Straits Settlements / Federated and Unfederated Malay States shall furnish such periodical reports and returns as may be required from time to time by the Government of India in respect of the welfare of the persons emigrating to the Colony in accordance with this Notification.

152·48/199

APPENDIX B.

G. O. No. 2710, Law (General) Dept. 13th November, 1923.

Information Relating to Malaya (Rule 17, Indian Emigration Rules, 1923).

NOTICE.

PENANG, SINGAPORE AND THE MALAY STATES.

Emigrants wanted for British Malaya, that is, for the Straits Settlements, Federated Malay States and other Malay States under British Protection.

Work is available in these countries for unskilled labourers on rubber and cocoanut estates as tappers and weeders or factory hands, on public roads and railways and other similar places of employment.

Climate.—It is never so hot in Malaya as in Madras. The rainfall is about 100 inches and is distributed more or less evenly during the year.

To go to British Malaya you can either pay your own fare, accompany a kangani from your own district paying neither rail nor boat charges, or if you apply in person at Avadi or Negapatam you will, if accepted, be sent over free of cost to yourself. None of the expenses incurred in bringing you over can be deducted from your wages. You will be landed free from debt and can leave your employer at any time on giving a month's notice. The journey from Negapatam to Penang takes four days.

If you go with a kangani you will find the work for which he recruits you written on his licence which also gives particulars of the rates of wages on his

estate. If you go by yourself on arrival at the port in Malaya you can go to work wherever you like.

No labourer is compelled to work more than 9 hours a day. On estates, in fact, weeders never work more than 8 hours and tappers never more than 6 hours a day. Work begins at 6 or 6-30 a.m.

No labourer is bound to work on more than 6 days in one week.

Wages vary according to locality. At present they range from 30–45 cents a day, *i.e.*, 9–12 annas for men, and 25–35 cents a day, *i.e.*, annas 7–10 for women. Wages must be paid at least once a month. Cash advances are usually made to labourers working on estates. Rice is also sold at cost price. If the labourer has no cash to pay for rice purchased, credit is allowed. At the end of the month when wages are paid the advance is deducted and also any money due on account of rice bought on credit. Only cost price of rice is recovered. No other deductions from salary are allowed.

On most estates even children over 10 years of age can get light work at 10–20 cents (2¾–5½ annas) a day. A labourer is paid only for days or parts of days on which he works. If he does half a day's work he is entitled to half the daily wage for that day. No fine is imposed for absence from work.

All estate coolies and most coolies employed on Government works are provided free of cost with houses built according to Government plan.

When sick, emigrants are either treated free in estate hospitals or else sent at their employer's expense to Government hospitals. Even if there is no hospital

on an estate there is at least a dresser to look after the health of the labourer.

Dollars 6 to 8 (Rs. 10.8.0 to Rs. 14) are found sufficient to supply an individual with food and clothing.

Repatriation.—Within one year of his arrival in Malaya any emigrant who has been assisted to emigrate at the cost of the Indian Immigration Fund shall, on satisfying the Agent of the Government of India in Malaya that his return to his home is desirable, either on the ground of the state of his health, or on the ground that the work which he is required to do is unsuitable to his capacity, or that he has been unjustly treated by his employer, or for any other sufficient reason, be repatriated free of cost to the place of his recruitment.

Even after the expiration of one year after his arrival any such emigrant who is incapacitated by illness or who owing to trade conditions is thrown out of work will be repatriated free of cost to the place of recruitment.

Where there is a sufficient number of children on an estate the Controller will order the Manager to provide a school and teacher. Nearly every estate has got its own temple.

Most estates have got vacant land on which labourers may have gardens and keep goats and cattle. Indians have the same rights as all other races in taking up State land and acquiring alienated land.

By the new Labour Code all penalties for labour offences will be abolished and the relation between the labourer and employer will be treated as of a purely civil nature.

APPENDIX C.

INDIAN IMMIGRATION FUND.

Straits Settlements and Federated Malay States

STATEMENTS OF ACCOUNTS

for the six months ending 30th September, 1923.

Indian Immigration Fund, Straits Settlements and Federated Malay States.

Income and Expenditure for six months ended 30th September, 1923.

EXPENDITURE.	$ cts.	$ cts.
IN INDIA—		
Railway fares under the Trainage Scheme ..	23,613 26	
Depot and Embarkation Charges ..	29,633 52	
Passages to Penang, Port Swettenham and Singapore ..	169,460 34	
Emigration Fees under Indian Emigration Act	18,788 57	
Expenses of Avadi Depot, Madras ..	2,557 13	
Expenses of Melpakkam Depot, Madras ..	1019 18	
Expenses of Kangany Camp, Negapatam ..	3,138 09	
Expenses of Papacovil Depot, Negapatam ..	184 11	
Advertisements ..	36 41	
Transport and Allowances	1,329 72	
Motor Car Allowance to Emigration Commissioner, Madras ..	857 16	
Miscellaneous Payments	723 02	
		251,340 51

INCOME.	$ cts.
Balance on 31st March, 1923 ..	1,813,963 66
Assessment ..	445,176 00
Redemption fees ..	60 00
Registration Fees ..	12,602 75
Interest on Daily Balances and Fixed Deposits ..	45,268 19
Miscellaneous Receipts ..	203 96
Hire of Passenger Barges ..	1,268 75
Interest on overdue assessment ..	143 92

IN STRAITS SETTLEMENTS AND FEDERATED MALAY STATES—

Expenses of Depots, Penang and Port Swettenham ..	1,683 85	
Landing Charges, Port Swettenham ..	330 05	
Maintenance of Passenger Barges Penang ..	2,019 23	
Sanitary Charges, Sungei Pinang Depot ..	912 50	
Quarantine Expenses ..	40,186 34	
Scavenging Charges, Pulau Jerejak ..	1,489. 62	
Transport Expenses of Labourers to Estates	13,906 91	
Recruiting Allowances	42,023 00	
British India Steam Navigation Company's Subsidy ..	28,881 00	
Registration Account (Payments) ..	1,310 00	
Carried over ..	$132,742 50	$251,340 51

Carried over .. $2,318,687 23

APPENDIX C.—*(Continued)*.

	$ cts.	$ cts.		
Brought forward ..	$135,742 50	$251,340 51	*Brought forward* ..	$2,318,687 23
Reserve Account for Reimbursement to Government on account of Salaries ..	25,100 41			
Reserve Account Audit Fees ..	864 36			
Motor Cycle Allowance to Indian Immigration Fund Inspectors ..	690 00			
Court Fees and Legal Expenses ..	168 50			
Transport Expenses of Un-official Members of the Indian Immigration Committee ..	240 78			
Depreciation ..	2,769 38			
Miscellaneous Payments	1,378 24			
Repatriation of and Assistance to Indian Labourers in need of Relief ..	8,652 19			
Distribution Camps ..	3,855 93			
Maintenance of Choultries, Penang and Port Swettenham ..	445 02			

Home for Decrepit Indians ..	5,764 20				
Transport and Allowances to Indian Immigration Fund Inspectors ..	330 03				
Expenses of Indian Unemployed Home ..	4,514 31				
Rent on Quarters for Staff ..	85 50				
Loss on Exchange ..	1,314 28				
		188,915 63			
Balance carried to Balance Sheet ..		1,878,431 09			
Total ..		$2,318,687 23		Total ..	$2,318,687 23

Indian Immigration Fund, Straits Settlements and Federated Malay States.

Balance Sheet—30th September, 1923.

LIABILITIES.	$ cts.	$ cts.
DEPOSITS—		
Kelantan Government	10,000 00	
Employers ..	2,258 69	
		12,258 69
SUNDRY CREDITORS—		
In India—		
Railway Fares under the Trainage Scheme	1,504 15	
Depot and Embarkation Charges ..	2,987 50	
Passages, Penang, Port S'ham and Singapore	31,982 00	
Emigration Fees under Indian Emigration Act ..	3,366 86	
Expenses of Avadi Depot, Madras ..	233 77	
Expenses of Melpakkam Depot, Madras	19 32	
Expenses of Kangany Camp, Negapatam	532 36	
Expenses of Papacovil Depot, Negapatam	29 71	

ASSETS.	$ cts	$ cts.
BANK BALANCES—		
Penang ..	288,686 83	
Madras Rs. 20,714-14-7 @ 175	11,837 09	
Negapatam Rs. 8,387-14-4 @ 175	4,793 08	
K. Lumpur ..	4,516 57	
		309,833 57
CASH BALANCES—		
Madras Rs. 10,066-12-6 @ 175	5,752 45	
Negapatam Rs. 2,189-02-2 @ 175	1,250 93	
K. Lumpur ..	25 00	
		7,028 38
INVESTMENTS AT COST—		
150,000 S.S. & F.M.S. 5% Victory Bonds (1934) 143,750		
245,000 S.S. 5½% Conversion Loan Bonds (1929) 222,775		

Transport and Allowances ..	97 56	
Motor Car Allowance, to Emigration Commissioner, Madras	142 86	
Advertisements ..	5 71	
Miscellaneous Payments ..	109 79	
		41,011 59
IN STRAITS SETTLEMENTS AND FEDERATED MALAY STATES—		
Expenses of Depots, Penang and Port Swettenham ..	75 64	
Quarantine Expenses	11,404 16	
Transport Expenses of Labourers to Estates	3,536 09	
Recruiting Allowances	752 00	
British India Steam Navigation Co.'s Subsidy ..	14,471 78	
Reserve for Reimbursement to Government on account of Salaries ..	32,558 15	
Carried over ..	$62,797 82	$53,270 28

115,000 S.S. 5½% War Loan Bonds (1928) 105,250			
500,000 7% S.S. Loan Bonds (1926) 500,000			
	971,775 00		
1,010,000 (Market Value at Date 1,072,100)			
Fixed Deposits Chartered Bank, Penang	550,000 00		
Fixed Deposits Peninsular and Oriental Banking Corporation, Madras, Rr. 100,000 at 175 ..	57,142 86		
Fixed Deposits Chartered Bank Madras, Rs. 50,000 at 175	28,571 42		
			1,607,489 28
Deposit with Port Trust Madras Rs. 200 at 174½ ..			114 61
ADVANCES—			
Petty Cash, Emigration Commissioner Rs. 300 @ 175 ..	171 43		
Carried over ..	$171 43		$1,924,475 84

APPENDIX C.—(*Continued*).

	$ cts.	$ cts.
Brought forward ..	$62,797 82	$53,270 28
Reserve Account Audit Fees ..	864 36	
Miscellaneous Payments ..	229 53	
Repatriation of and Assistance to Indian Labourers in need of Relief ..	474 11	
Distribution Camps	740 08	
Motor Cycle Allowance to Indian Immigration Fund Inspectors ..	35 00	
Suspense Account ..	621 43	
Transport Expenses of Unofficial Members of the Indian Immigration Committee	63 44	
Sanitary Charges, Sungei Pinang Depot	58 50	
Transport Expenses of Unemployed ..	2 75	
Maintenance of Passenger Barges	36 80	
Expenses of Indian Unemployed Home	203 87	

	$ cts.	$ cts.
Brought forward ..	$171 43	$1,924,475 84
Miscellaneous Deposit Account Penang (for Branch a/c India)	2,000 00	
Advance to Medical Officer for purchase of Motor Car ..	1,714 29	
		3,885 72
		1,928,351 56
STOCK OF CLOTHING—		
In Store in Penang		632 03
MELPAKKAM DEPOT—		
Cost of Land and Buildings per last Balance Sheet ..	8,987 33	
Less Depreciation 10 per cent. ..	898 73	
		8,088 60
CHOULTRY—		
Value of Choultry Penang per last Balance Sheet ..	2,531 09	
Less Depreciation 10 per cent. ..	253 10	
		2,277 99

Scavenging Charges, Pulau Jerejak ..	256 95	
Landing Charges ..	45 00	
Transport and Allowances to Indian Immigration Fund Inspectors ..	113 18	
Court Fees and Legal Expenses ..	38 00	
		66,580 82
Reserve Account for Bad and Doubtful Debts ..		89,611 50
Balance from Income and Expenditure Account ..		1,878,431 09
Total ..		$2,087,893 69
Carried over ..		$2,087,893 69

Value of Choultry Port S'ham per last Balance Sheet ..	3,200 00	
Less Depreciation 10 per cent. ..	320 00	
		2,880 00
PASSENGER BARGES—		
Value of 4 Passenger Barges per last Balance Sheet ..	12,288 00	
Less Depreciation 10 per cent. ..	1,228 80	
		11,059 20
DISTRIBUTION CAMPS—		
Value of two temporary sheds per last Balance Sheet	68 75	
Less Depreciation being balance of amount written off	68 75	
		1,953,289 38
SUSPENSE ACCOUNT ..		2,648 78
SUNDRY DEBTORS—		
Assessment due on Notices issued to 30th September, 1923 ..	96,007 94	
Carried over ..	$96,007 94	$1,955,938 16

APPENDIX C.—(*Continued*).

	$ cts.	$ cts.		$ cts.	$ cts.
Brought forward ..	$96,007 94	$1,955,938 16	*Brought forward* ..	96,007 94	$1,955,938 16
			Estimated Assessment due on Notices not issued to 30th September 1923 ..	5,669 00	
			Accrued Interest due on Investments to 30th September, 1923 ..	21,596 35	
			Accrued Interest on Fixed Deposits, Penang, to 30th September, 1923	5,463 70	
			Accrued Interest on Fixed Deposits, Madras ...	1,578 08	
					130,315 07
			PURCHASE OF LAND AT AVADI ..		1,640 46
		$2,087,893 69			$2,087,893 69

27th November, 1923.

G. A. SMITH,
Deputy Controller of Labour, Penang.

I have examined the foregoing Income and Expenditure account and Balance Sheet with the books and vouchers of Indian Immigration Fund, and subject to the queries addressed to the Deputy Controller of Labour, Penang, certify that they are in accordance therewith, and that the Balance Sheet, is, in my opinion, properly drawn up so as to exhibit the true and correct position of the Fund as shown by the books on the 30th September, 1923. The value of the stock of clothing is certified by the Deputy Controller of Labour, Penang.

W. A. WHITE,
Director of External Audit Department.
Straits Settlements.

APPENDIX D.

F.M.S. LABOUR CODE, 1923.

CHAPTER XIII.

Standard Rates of Wages.

Standard rates of wages

141. (i) It shall be lawful for the Indian Immigration Committee from time to time with the approval of the Chief Secretary to Government by notification in the Gazette to prescribe standard rates of wages payable to all or any classes of labourers performing all or any of the kinds of labour specified in section 122 in areas to be set forth in such notification.

(ii) The Indian Immigration Committee shall give reasonable notice, to be published in the Gazette and in at least three issues of not less than one English and one Indian vernacular newspaper circulating, if any, in the area or areas to be affected of its intention to fix such rates at a meeting of which the date and place shall at the same time be notified. All persons interested including the Government shall have the right to appear and be heard before the Indian Immigration Committee at such meeting. Any agent of the Government of India appointed under section 7 of the Indian Emigration Act, 1922, shall be deemed to be a person interested. The Indian Immigration Committee may at its discretion allow such persons interested to appear by solicitors or by the duly

authorised and usual agents of duly constituted bodies or by other representatives, and may order that any class of persons having a common interest shall appear by such solicitors agents or other representatives.

(iii) The date or dates from which such standard rates are to come into force shall be stated in the notification referred to in sub-section (i), but shall not be earlier than two months after the date of publication of such notification.

(iv) Standard rates of wages mean the rates proper for an able-bodied male labourer above the age of sixteen or for an able-bodied female labourer above the age of fifteen for a day's work or equivalent task as provided by section 68.

MALAYAN SERIES No. XII.

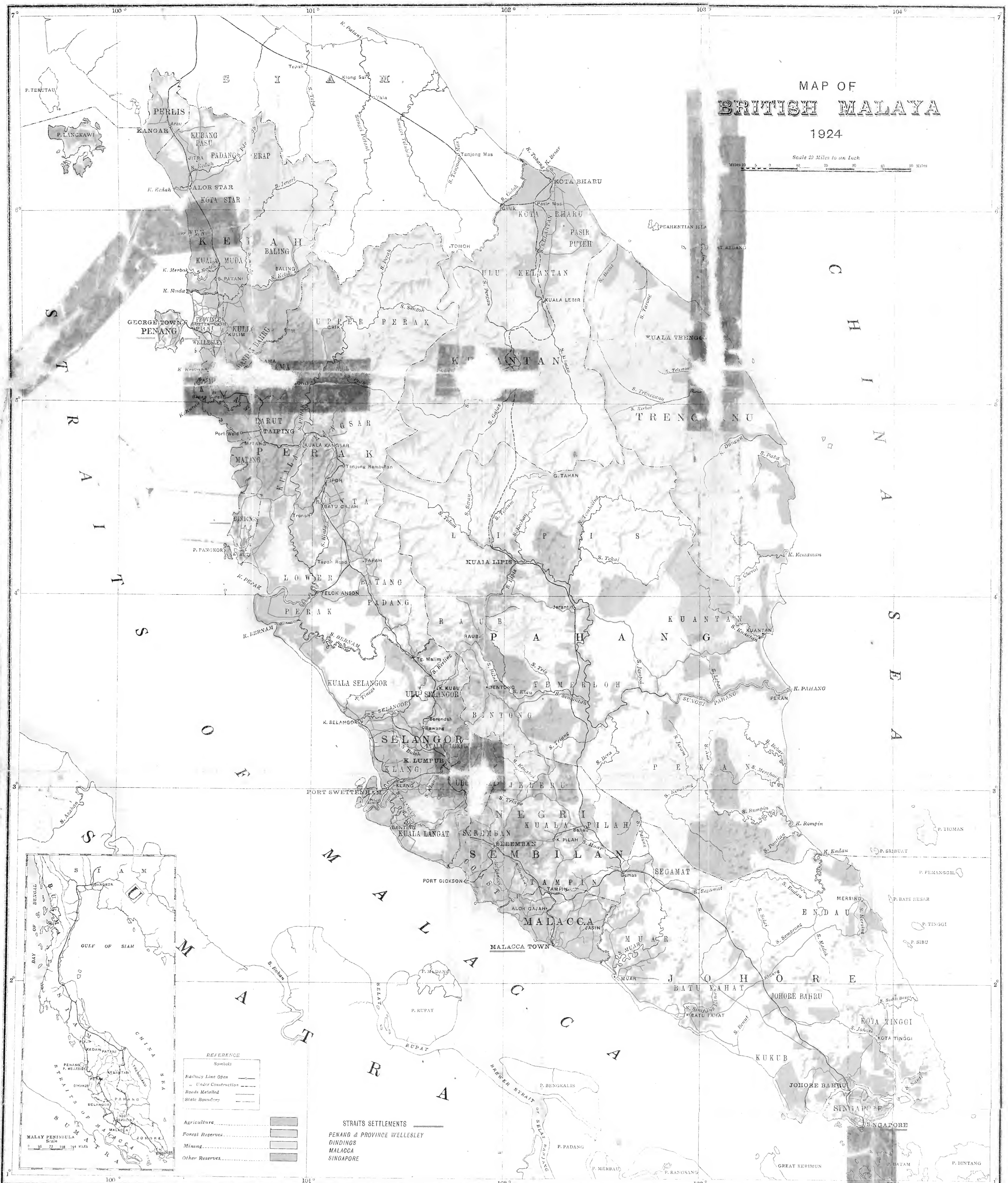
Railway, Road and Shipping Facilities in the Malay Peninsula.

16/10/24

British Empire Exhibition,

London. *1924.*

Price 20 cents or 6d.



F. M. S. Surveys No. 15-1924

Printed for The Malayan Governments by Fraser & Neave, Ltd., at Singapore, in the Colony of the Straits Settlements

and on

RUBBER LATEX PAPER.

Railway, Road and Shipping Facilities in the Malay Peninsula.

SINGAPORE:

FRASER AND NEAVE, LIMITED, PRINTERS.

1923.

Ginting Simpah Road.

Railways in the Malay Peninsula.

THE Federated Malay States Railways system serves not only the Federated Malay States proper but also the Straits Settlements and the Unfederated States of Kedah, Perlis, Kelantan and Johore. Of the 1,022 miles of line open for traffic the Federated Malay States Government owns all but 120 miles running through Johore State. The entire system is operated by the Federated Malay States Railways, the Johore line being leased to it by the Johore Government.

The first length of line laid was from Taiping to Port Weld in Perak, a distance of 8 miles. This line was built by Perak State and was opened for traffic on 1st June, 1885.

In the following year, the first line in the State of Selangor was opened from Kuala Lumpur to Klang—a distance of $21\frac{1}{2}$ miles.

Steady progress was maintained in both States, and in 1901 the first General Manager and Chief Engineer was appointed to control both the Perak and Selangor State Railways. The mileage open for traffic by the end of 1901 had increased to 244 miles, of which 97 were in Selangor and 147 were in Perak. By the end of 1903 the mileage open for traffic had increased to 340 miles, the two

systems had linked up and through communication was established from Penang in the North to Seremban in Negri Sembilan.

During 1904 the main line was carried further South towards Malacca and Johore State. An agreement was also completed with Johore State Government for the construction of a line from the Federated Malay States frontier to Johore Bahru opposite Singapore Island, and the construction of this line was started from the Southern end in December, 1904, and from the Northern end in March, 1905. This line ran through jungle for practically the whole length, and when the survey started in March, 1904, great difficulty was experienced owing to the total lack of communications over 100 of the 120 miles the line was to cover. Except in the vicinity of Johore Bahru itself roads were unknown. The first portion of this line to be opened was a section of 16 miles from the Negri Sembilan border to Segamat on 1st March, 1908. By August, 1908, 70 miles were ready for traffic, but were not opened as the Johore Government wished to have the whole of the remaining portion of the line opened at the same time. This was done on 1st July, 1909, and through communication was thereby established between Penang in the North and Johore Bahru in the South. Following close upon this came the completion of a wagon ferry across the Straits separating Singapore Island from the mainland. This was opened on 1st January, 1910.

The Singapore Government had already opened a line in January, 1903, running from Woodlands on the Northern coast of Singapore Island to Singapore

Ginting Simpah Road.

itself ($19\frac{1}{2}$ miles) and this was purchased by the Federated Malay States Government in 1913. With the inclusion, in 1912, of the Johore State Railway in the Federated Malay States Administration, and the extension of the main line through Kedah to Alor Star (the Capital) in 1915, and subsequently through Perlis to the Siamese frontier at Padang Besar in March, 1918, the Malay Peninsula found itself with a well equipped railway worked by one Administration offering transport facilities from end to end of the Peninsula and a service for both freight and passenger traffic that is not surpassed in any Colony or Protectorate.

Up to 16th September, 1923, freight traffic across the Straits from Johore Bahru on the mainland to Singapore was carried by wagon ferries, transhipment thus being obviated. Passengers were taken over by a passenger launch. A Causeway across the Straits has now been partially completed and was opened to railway goods traffic on 17th September, 1923, and the first through passenger train between Kuala Lumpur and Singapore passed over the Causeway on 1st October, 1923. The construction of the Causeway was commenced towards the end of 1919, and when completed it will be 60 feet wide on top carrying two tracks of Railway and a 26 feet roadway. Its length will be 3,465 feet and the average depth of water in which it is built is 46 feet at low tide. On the Johore side a lock has been constructed through which local craft may pass. A rolling lift bridge, the only one of its type in this part of the world, carries the Railway and roadway across the lock. The weight of the moving part of the bridge is 570 tons and it is operated electrically.

A model of this Causeway is on view in the Exhibition.

Meanwhile, sight had not been lost of opportunities for linking up coast towns and for opening feeder lines. As far back as 1893, the Port of Teluk Anson in Perak was linked up to the main line at Tapah Road, serving an important rubber growing and tin mining centre. The Kinta Valley—the most important tin mining district in the world—was further tapped by the construction of a line from Ipoh (Perak) to Tronoh (16 miles) opened in 1905. In Selangor in the same year a branch line was opened to serve the Railway Workshops, on the outskirts of Kuala Lumpur, and the quarries at Batu Caves, where there are unlimited supplies of road metal. This also, is a rubber growing district. Tin mines at Ampang near Kuala Lumpur were supplied with a line constructed in 1914. In the following year, an important branch line was opened for traffic from the Malayan Collieries at Batu Arang joining the main line at Kuang—7 miles away. This branch has since been extended for 7 miles towards the West coast. Port Swettenham on the West coast 5 miles beyond Klang, to which point the first Selangor line was built in 1886, was connected up in January, 1899, and shipping has grown rapidly, since Port Swettenham offered facilities which the older port of Klang, served only by river could never offer. Ships of the most prominent freight lines trading to the East can be seen here at any time discharging machinery, railway material, foodstuffs, and quantities of other articles required for a rapidly developing country, or loading cases of rubber or tin ore, the two principal exports from this Peninsula.

The wharves admit of ocean going boats coming alongside, while there is ample accommodation in the roads for boats discharging into tongkangs or lighters.

Large warehouses have been constructed close to the wharves for the storage of rubber, rice, and there is a regular service of freight trains to all parts of the Peninsula and Siam.

Passenger boats, both local and those trading to Europe, also call at the port, meeting the need of the thickly populated central portion of the Peninsula which forms the hinterland.

From Klang, a line has also been constructed to serve an important agricultural district along the Selangor coast. This line extends for 30 miles and was completed in 1914.

In Negri Sembilan and Malacca, branch lines run from Seremban to Port Dickson and from Tampin to the old and historical port of Malacca. The Seremban to Port Dickson line (24½ miles) originally belonged to a private Company and was purchased by the Federated Malay States Railway Department and worked by the Department from 28th July, 1908. The extension from the main line to Malacca Town was opened for traffic in December, 1905.

A glance at the map of the Malay Peninsula will show that the West coast is much more developed than the East and naturally the first lines were built where most required. The East coast is not at present served by railway except in the Northern portion of the State of Kelantan, where the Federated Malay States system joins the Siamese State Railways again at Sungei Golok. Southwards

through Kelantan a line is being built to run through Pahang and Negri Sembilan and join the West coast line at Gemas on the Negri Sembilan—Johore State boundary.

In the North this new line was opened from Tumpat for 32 miles South in 1914. At the Southern end 146 miles from Gemas have been completed and are being operated through the States of Negri Sembilan and Pahang. This line has one branch serving agricultural district from Bahau to Kuala Pilah (13 miles) opened in 1910.

The total length of line opened for traffic at the end of 1923 was 1,022 miles and 70 additional miles were actually under construction. The Railway is mostly single line and of metre gauge throughout, corresponding with the Siamese Railways.

The Workshops referred to above are near Kuala Lumpur and deal with the maintenance and repair of locomotives and rolling stock. Locomotives are usually manufactured in England and erected at the Central Workshops, but the goods and passenger stock is manufactured here from local timber. These Workshops are fully equipped with the modern machinery essential to such an establishment.

Sleeping saloons and dining cars have been running on the night mail trains between Kuala Lumpur and Johore Bahru since 1911. In 1920 similar accommodation was provided on the through trains between Kuala Lumpur and Prai (Penang). Both the sleeping saloons and dining cars are built at the Railway Workshops and will stand comparison with the stock of any railway in the world. A sectional model of a sleeping saloon with transverse

Waterfall Road, Taiping.

berths, a construction believed to be unique on metre gauge railways, will be found in this Exhibition. The cabins in the sleeping saloons are roomy, fitted with electric light and fans; the restaurant cars likewise are fitted with electric light and fans and a really good breakfast, luncheon or dinner is put up by the Chinese staff provided on these cars. The latest development in this direction is the provision of a Buffet Car for running on long distance trains.

At Ipoh and Kuala Lumpur, Railway hotels adjoin the Station and provide all the facilities of first class accommodation.

The Federated Malay States Railways are equipped to handle every description of present day traffic and in addition to wharves at Port Swettenham an extensive scheme of wharves has just been completed at Prai so as to provide a terminal port where the largest ocean-going vessels frequenting Far Eastern ports could come alongside the wharves and discharge direct into Railway wagons or into the transit sheds on the wharves. A model of the Prai River Wharves is on view in the Exhibition.

It soon became evident with the linking up of the Federated Malay States Railway system with that of the Siamese system, that a very real demand for a quick and comfortable service between Penang and Bangkok was created. This problem was solved by the introduction of a Through Express Service between Penang and Bangkok bringing the latter town within 34 hours of Penang and within 60 hours of Singapore. This service has been so successful that it is more than probable that it will be run twice a week in the near future.

The standard locomotive in use on the Federated Malay States Railway is of Pacific type and weighs engine only, 55 tons, engine and tender 75 tons. The present maximum axle load is 12 tons, but the future maximum now allowed for in specifications is 16 tons. A few Mallet type articulated locomotives are also in use.

The fuel for these locomotives is now obtained from the Malayan Collieries near Rawang, but previous to the development of this coal field, Bakau wood, cut from the Bakau swamps, was largely used, supplemented by imported coal.

All the passenger vehicles are bogie stock, corridor type. The standard goods wagon is a 10 ton four-wheeled vehicle, but there are, of course, special vehicles in use.

Probably in no other country in the world has railway development been so rapid as in the Federated Malay States and it is a remarkable fact that up to the year 1922 the money to construct this fine system of Railways has been obtained from the revenue of the Federated Malay States as a whole.

The Peninsula offers a fine field for the tourist and attractions for those who are merely birds of passage en route to the Far East. Travellers arriving by outward bound boats can disembark at Penang and have sufficient time to travel through the Federated Malay States and rejoin their boats at Singapore. This will admit of a break in the journey at either Ipoh or Kuala Lumpur, or probably both, which will well repay the trouble taken. There is of course ample scope for the tourist wishing to spend a week or a month in the Peninsula. There

will be found plenty to amuse, educate and interest him. The roads throughout the Peninsula are uniformly excellent, and the temperature and scenery make motoring a real pleasure.

THE ROADS OF MALAYA.

Malayan Roads are of recent growth and started from very small beginnings, viz., tracks cut through virgin jungle connecting administrative or mining centres with the rivers which in the early days were the only means of communication with the outer world.

As the prosperity of the country increased and the necessity for adequate communication became more urgent, these tracks gave place to bridle paths and bridle paths to metalled cart roads.

The first cart road of any importance in the Federated Malay States was constructed by the Royal Engineers between Matang (then a port) and Larut (Taiping) an important tin mining centre, during the Perak War in 1875.

Subsequently, as each State of the Federation came under British influence it worked out its own road system as and when necessity or opportunity presented itself.

The whole country at this time was covered with virgin jungle and the problems presented to the engineer were not simple; he could not see 20 yards in any direction without cutting his way; he had to keep his costs down to a minimum and his object was to provide an easy grade (1 in 40) for slow moving and heavily laden bullock carts; his was not to design broad motor roads with easy curves, nor had he to consider the necessity for

feeding the railways; these came after and it was not until after federalization in 1895 that our rulers began to think of the main trunk roads and through railway communication which we enjoy to-day.

With the advent of motors in 1902, a systematic overhaul of the roads of Malaya was instituted and large sums were spent annually on road improvements; temporary bridges were substituted by permanent ones, roads were widened, deviations made to avoid bad curves and incidentally reduce the mileage, blind corners were cut back, and in many cases the whole bearing surface of the road was reconstructed with proper foundations and top metalling as seen at the present day.

The standard aimed at for country roads is a 16 feet metalled surface composed of a bottom layer 6 inches thick of large stones hand packed and consolidated, over which is laid some 4 inches of metal broken to a 2 ins. or 2½ ins. gauge, the whole after consolidation, being not less than 8 ins. in thickness and laid upon a formation 22 feet in width between drains, no gradient to exceed 1 in 40 unless in mountainous districts, and if possible to be reduced to 1 in 60, and no bend to be so sharp that it will not afford the traveller a view of the road for, at least, 2 or 3 chains in front of him.

All roads are marked with mile, half mile and quarter mile posts, the mileage being taken from the capital of each State.

Construction of roads is, in the main, carried out by Chinese Labour; Maintenance of metalled surfaces being performed by Tamils who are comfortably housed on selected sites convenient to their work.

Gopeng Road.

Generally speaking, there are outcrops of metal suitable for road making at fairly frequent intervals throughout the Peninsula so that, in the matter of maintenance, the cost of transport falls within the limits of reasonable economy, with the exception of the Coast Districts where outcrops of suitable material do not occur so frequently and transport by sea and river has to be resorted to, usually a slow and tedious affair, as the native boatman is prone to take his own time when out of sight of European supervision; the alternative being to obtain suitable material by rail from the inland outcrops which adds considerably to the cost.

The class of metal usually favoured by Engineers is, in order of merit, Granite, Limestone and Laterite; of these the two former are practically inexhaustible and are generally used on all main roads; the latter variety is used chiefly in agricultural districts and on the coast when obtainable.

Under light traffic conditions laterite makes an ideal surface for motoring, as smooth as a well kept carriage drive and restful to the eye.

A large percentage of the main trunk roads carrying heavy traffic have been treated with bituminous products, thus adding greatly to hygienic conditions and the comfort of travellers.

The use of waterproofing material has been found to prevent wash and scour on the metalled surfaces caused by tropical rains; it provides an excellent surface for motor traffic and prolongs the life of the metal.

In jungle or rubber forests the thus blackened surfaces merge into the surrounding gloom and it has been found necessary to demarcate the safe surface for traffic by planting white painted posts.

To-day it is possible to motor from Penang to Singapore crossing by the F.M.S. Railway Ferry from Penang Island to Prai; the road leads through typical Malayan scenery from Prai through Province Wellesley to Gunong Semanggol, practically the whole country being under padi (rice) cultivation, thence to Taiping the capital of Perak and over the pass to Kuala Kangsar the residence of His Highness the Sultan, crossing the pontoon bridge spanning the Perak River, which is 750 feet wide at this point, to Ipoh, the mining centre of Perak; thence through country of striking limestone cliffs at Gopeng, rubber estates, tin mines and virgin jungle till Kuala Lumpur, the Federal Capital, is reached.

From thence the traveller proceeds over the Setul Pass to Seremban, the capital of Negri Sembilan and via the old-world town of Malacca into the Unfederated State of Johore; at Johore Bahru the Causeway is crossed and so to Singapore the total distance being 506 miles.

Likewise the motorist may cross the Peninsula from west to east, starting from Port Swettenham and passing through Klang, a thriving centre of the rubber industry, to Kuala Lumpur; thence he has the alternative of two mountain roads crossing the main range, the one via Kuala Kubu over the Semangko Pass (2,800 feet) to Raub, the other over Ginting Sempah (2,000 feet) to Bentong a mining village, and so on to Raub; thence to Benta, where,

leaving Kuala Lipis the capital of Pahang, some 16 miles to the left, the traveller passes through about 150 miles of practically virgin jungle, crossing the railway at Jerantut and the Pahang River by ferry, eventually reaching Kuantan on the China Sea. The total distance across being 282 miles.

From these two main arteries radiate other roads connecting up the centres of industry and administration in the various States. There is scarcely a rubber estate or a tin mine in the whole of Malaya that has not a frontage on, or easy access to, a metalled cart road constructed and maintained at the expense of Government.

The total mileage of metalled cart roads suitable for motor traffic in the Federated and Unfederated Malay States is 3,473 miles.

In the Federated Malay States, Perak has 875 miles, Selangor 777 miles, Negri Sembilan 447 miles, and Pahang 358 miles. In the Unfederated States, Johore has 580 miles, Kedah 324 miles, Kelantan 100 miles and Trengganu 12 miles. Johore and Kedah being connected up with the Federated Malay States Road System and that of the Colony.

The roads of Kelantan are connected with the Federated Malay States Railways, those of Trengganu are isolated.

During the lean years following the Great War, but little road development and construction has been carried out. Existing roads have, however,

been maintained in a reasonable state of repair; and in anticipation of future prosperity, a programme for the construction of new roads has been prepared with a view to opening up new territory, embracing extensions amounting to 463 miles in Perak, 247 miles in Selangor, 169 miles in Negri Sembilan and 657 miles in Pahang.

Speaking in London at the Imperial Motor Transport Conference of October 20th 1920, the Malayan Roads were described by an American citizen in the following words:—

> "Travellers of experience will tell you that they are the finest laid and maintained Roads of their class in the world. Personally I have been associated with road transport and road making in various parts of the world during the last 25 years—7 of which have been spent in Malaya. I have travelled most of the Roads out there and I can therefore speak with enthusiastic appreciation of the magnificent work in the laying of these splendid roads through swamps and jungle, and in the execution of which the Engineers had to face all the dangers to health and the sacrifice of all social life and home ties as required from all those who engage in pioneer work. They are, indeed, the Silent Empire Builders to whom no glory is usually awarded, but over whose roads the Empire is nevertheless indebted for much of that trade and prosperity which makes her the leading nation in the world."

Main Road, Kuala Kangsar.

Shipping Facilities.

British Malaya is singularly fortunate regarding sea communications with other countries, and has exceptional facilities for dealing with the requirements of the large volume of steamship, passenger and goods traffic which passes annually through its seaports. The principal ports in the order of their importance are:—Singapore, on Singapore Island at the Southern end of the Peninsula; Penang on Prince of Wales' Island off Province Wellesley and Port Swettenham at the mouth of the Klang River, within a short distance either by rail or road, of Kuala Lumpur.

The Steamship routes from Europe, Africa, India and Ceylon to the Far East, and from America (Pacific seaboard), Japan, China, Australia, Java, Indo-China, Borneo and Siam, to India, Ceylon, Africa and Europe, converge at Singapore which is one of the most important of the world's seaports.

STEAMSHIP SERVICES TO MALAYAN PORTS.

From Europe.

Regular services are maintained from Europe to Malayan Ports by the Blue Funnel, Ben, Chargeurs Reunis, Compania Trasatlantica (Spanish Mail), Ellerman & Bucknall, Glen, Lloyd Triestino, Messageries Maritimes, Nippon Yusen Kaisha, Nederland Royal Mail, North German Lloyd, Osaka Shosen Kaisha, Peninsular & Oriental Steam Navigation Co., Prince Line, Rotterdam Lloyd Lines. Of these

Lines the Nederland Royal Mail and the Rotterdam Lloyd have their terminal ports in Java and the others proceed eastward from Singapore to China and Japan.

From India.

Bombay:—The P. & O. S. N. Co., Nippon Yusen Kaisha and Osaka Shosen Kaisha.

Calcutta:—The British India via Rangoon and direct; the Indo-China Line.

Madras:—The British India Line.

From Australia and New Zealand.

Melbourne, Sydney etc.:—The Burns Philp Line and Koninklyke Paketvaart Maatschappij (Dutch Packet Co.).

Fremantle and North Western Australia Coast Ports:—Western Australia Steam Navigation Co., Ocean Steamship Co., State Shipping Service.

From China and Japan.

See Lines mentioned in the paragraph devoted to services from Europe. In addition there are the British India and Indo-China Lines from Japan and the service which is maintained by the Koninklyke Paketvaart Maatschappij, between Hongkong, Singapore, Belawan Deli and Penang.

From South Africa.

Cape Town and Durban:—Nippon Yusen Kaisha and Osaka Shosen Kaisha.

From Canada and United States of America.

There are several direct cargo Lines running to Malaya but passengers routed via the Atlantic

tranship at a European Port and passengers routed *via* the Pacific change either at a Japan or a China Port, usually at Hongkong.

From South America.

Rio de Janeiro and Monte Video:—To Singapore via South Africa, by Nippon Yusen Kaisha and Osaka Shosen Kaisha.

LOCAL SERVICES.

The visitor from overseas must tranship either at Penang or at Singapore whence local service Steamers fitted with comfortable accommodation specially designed for the tropics, leave at frequent intervals.

The Straits Steamship Co., (managed by Alfred Holt & Co.), The Koninklyke Paketvaart Maatschappij, The Blue Funnel Line, The Peninsular & Oriental Co., and the Siam Steam Navigation Co., provide services from Penang, Singapore etc., to all important points throughout Malaysia and to Siam, Indo-China, Borneo and the Philippines.

Straits Steamship Company.

The principal services of this Line are as follow:—

1. Singapore to Miri, Labuan, Jesselton, Kudat, Sandakan, Jolo and Zamboanga.
2. Singapore to Bangkok.
3. Singapore to Port Swettenham and Penang.
4. Penang to Belawan Deli.

In addition there are several coastal services.

Koninklijke Paketvaart Maatschappij.

The local Steamers of this Line serve all ports in Sumatra, Java, Dutch Borneo, Celebes and the Netherlands East Indies generally.

The Blue Funnel Line.

This Company maintains a bi-weekly service between Singapore and Belawan Deli (Sumatra).

The Peninsular & Oriental Company.

The P. & O. Steamer from Singapore, Port Swettenham and Teluk Anson to Belawan Deli leaves these ports at intervals of ten days.

PRINCIPAL PORTS.

Singapore.

The approach to the harbour is very beautiful and is surpassed only by that of Rio de Janeiro, Sydney and, perhaps, Hongkong.

Steamships of 20,000 tons register are able to approach the deep water wharves at all states of the tide. The difference between the rise and fall of the ordinary spring tides is nine feet.

During the year 1922 no less than 42,154 vessels representing a tonnage of over twenty million, were entered and cleared at Singapore. These figures comprise warships, merchant vessels and native craft.

Singapore is shewn in Whitaker (1922) as ranking next below Liverpool in the matter of merchant tonnage entered and cleared.

Pass between Taiping and Kuala Kangsar.

The majority of ocean going Steamships are berthed at the Singapore Harbour Board's Wharves but certain vessels discharge and load in the inner and outer Harbours which necessitates the employment of a large number of lighters between the ships and the shore.

The wharves owned and controlled by the Singapore Harbour Board total over ten thousand feet in length which includes 4,412 feet of wharves at which the depth of water at low water (ordinary spring tides) is 33 feet and over.

The storage capacity of the Board's premises on and near the wharves is 260,000 tons of cargo and 200,000 tons of coal.

A model of the Singapore Harbour Board's premises, docks and wharves is on view in the Exhibition.

The Peninsular & Oriental Steam Navigation Company has its own wharves.

Singapore is a free port there being no Customs Duties. Excise Duties are levied on alcoholic liquors, opium, tobacco and petroleum.

Singapore is the principal shipping and transhipment port for the Malay Peninsula, Siam, Indo-China, British Borneo and an extensive portion of the Netherlands East Indies. There is also a large volume of trade with India, China, Japan and Western Australia.

Penang.

Penang Harbour is situated on the East side of Penang (Prince of Wales) Island which is mountainous and affords excellent shelter to the Port.

Large ocean-going steamers drawing 18 feet can enter only by the Northern Entrance and vessels drawing over 26 feet have to study the tides.

Swettenham Pier having a length of 1,200 feet with a minimum depth of 30 feet low water (ordinary spring tides) is used principally by the mail steamers and large liners. Vessels of all descriptions anchor in the harbour, landing passengers by launch and discharging cargo by lighters. The Penang Harbour Board possess about 80 lighters, and cargo can be transferred by these direct to the Board's godowns, under European supervision.

During the year 1922, 17,434 vessels representing a tonnage of over 8,000,000 were entered and cleared at Penang. These figures comprise Merchant vessels, Native Craft, Warships, etc.

There are no port dues.

The new wharves on the other side of the harbour at Prai (mainland) with a length of 2,400 feet enable lighters from vessels working in the roads to discharge their goods direct to the railway wagons.

Prai is in direct rail communication with the Malay States and Siam.

Port Swettenham.

This port is situated at entrance to the Klang River. The Harbour is completely landlocked. The minimum depth over the bar at the Southern Entrance is 22 feet; the average rise of tide above this depth is 15 feet at springs and 9 feet at neaps. The minimum depth in the anchorage is 32 feet.

There is one wharf of 1,000 feet in length with a minimum depth of 33 feet of water alongside; three T headed wharves each 100 feet long with fifteen feet of water and a pontoon wharf 200 feet in length with 16 feet minimum depth of water.

Passengers land at the Passengers Pier which leads immediately to the Railway Station platform. Goods are either landed by Federated Malay States Railways lighters or, in the case of vessels moored alongside the wharf, direct into the railway wagons.

There is ample storage accommodation in the Railway's corrugated iron godowns.

Port Swettenham is connected by railway and road with Klang, Kuala Lumpur, etc.

Three hundred and forty ocean-going ships used the port during 1922; their tonnage amounted to 1,317,721 tons.

FURTHER INFORMATION.

Information regarding sailings, passenger fares and cargo rates can be obtained from the Companies direct or from Thos. Cook & Son's Offices throughout the world.

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Malay Woman moulding Pottery near Kuala Kangsar, Perak.

Malay Arts & Crafts

By IVOR H. N. EVANS.

THIS little pamphlet is intended to be a short and concise guide to modern Malay arts and crafts. Those which are obsolete, or obsolescent, are dealt with very briefly.

In undertaking the study of Malay arts and crafts it must be remembered that the Malay is emphatically not a specialist; one man may be clever at carving, another at silver-work, and so on, but it is probable that each craftsman is also, and possibly first and foremost, a rice-planter. This fact, with the Malay craftsman's lack of capital and his dislike of continuous and monotonous work, has tended to ruin native handicrafts. The Chinese goldsmith works regularly, lives in an easily accessible place—the local township, which everybody visits occasionally—and has sufficient capital to keep a stock of silver and gold in hand with which to fulfil orders, while he has also a display of ready-made jewellery, especially of such articles as are in frequent demand, these being the products of his labour when orders are slack.

The Malay jeweller has no stock of gold or silver and requires an advance to purchase the material for an order, which he may be some time in obtaining, works irregularly because he has other matters to attend to and does not care much regular work anyhow, has no stock of ready-made articles and, perhaps, lives in some inaccessible village, ever so far from anywhere.

Can it be wondered then that even the easy-going Malay takes his orders to the Chinaman from whom he may be able to obtain what he wants out of hand, or who will promise to have his order complete within a few days and will not disappoint him?

It is unfortunate that the Malay craftsman will not specialize and is not more commercially-minded, for he is certainly capable of turning out very beautiful work. His silver work is most artistic and mellow both in shape and design, his carving pleasing, while the clothes, mats and embroidery made by the women often reach a high standard of excellence. Pottery, again the work of women, is often of beautiful shape, though made in the most primitive way, while the Malay creese-smith is far-famed for the damasked steel of the blades which he manufactures.

Pottery. There are now very few stations in Malaya where pottery is made. In Perak there are a few villages on the river which gives its name to the State where quite good work is turned out, the potters of Sayong and Pulau Tiga and of a village near Lenggong, in Upper Perak, still carrying on a small trade, but the industry has, I believe, died out at Bukit Gantang, where pottery was made a few years ago. Malay pots are also made near Kuala Pilah in Negri Sembilan, around Kuala Tembeling in Pahang, at Kuala Kerai in Kelantan and in one part of Kedah. These are the only recorded, or known, localities where pottery is manufactured.

It is curious that though the Malays have been in contact with the Chinese and with various peoples of India for so many centuries, the potters' wheel has never gained a footing in the country. In Pahang the ·earest substitute for it is a round, rattan winnowing-

tray which is rotated with one hand by the potter as she builds up, or smooths, the pot which she is making. In Perak a saucer takes the place of a winnowing-tray, though a round block of wood rotating on another, which has a central peg fitting loosely into a hole in the upper disc, is occasionally used instead, and forms the nearest known approach to the potter's wheel.

The most commonly manufactured articles of pottery are water-bottles, water-jars and cooking-pots, though incense-burners, steam-cookers, drinking-cups, small plates and other articles are also made.

The shape of the water-bottle is nearly always based on the ordinary bottle-gourd which is still used as a water-vessel in many poor-class Malay houses, especially up-country. The clay article, called an "earth gourd" by the Malays, may follow the shape of the fruit exactly, a gourd with either one or two bulges, or may have adornments or fittings, such as flutings or a foot, or the shape may be varied somewhat. A curiously-shaped water-bottle with a spout is, however, still made in Negri Sembilan and I have shown elsewhere that this is probably derived from the ancient Hindu *kendi*, a word which still persists in the Malay language as a name for a kettle. During the Ming dynasty, Chinese porcelain bottles of the same type were exported to the East Indies, but I think it probable that these were manufactured to please the local taste and have not been able to obtain evidence that they were ordinarily in use in China. The Chinese have for many centuries been turning out goods adapted to meet the demands of their foreign customers and old Chinese plates with Arabic, or mock

Arabic, inscriptions, Canton enamel *sireh*-sets and porcelain decorated in the Siamese style are not uncommonly to be found.

With regard to Malay water-pots, they are often furnished with a little plate, which is placed as a cover over the mouth of the vessel, and with a small bowl, a drinking-cup, which may rest on the plate. The plate protects the water from contamination, as well as affording a resting-place for the cup.

There is no doubt that the primitive cup was half a coconut shell; the bowl-cups are modelled exactly on this shape. With regard to the water-pots, it is less easy to say whether they were derived from some more primitive utensil, but a suggestion has been made that they may have been copied from another type of native coconut water-vessel, a water-pot which is usually contained within a rattan binding, and has a loop attached for carrying it. If this is correct, its shape has certainly diverged a good deal from the original model.

Apart from the substitute for the wheel, which I have mentioned already, Malay potting tools are of the simplest description—a small wooden bat, commonly used for tapping the pots into shape; a rounded quartz pebble for finishing off surfaces; a bamboo sliver for cutting away, or scraping away, superfluous clay, and, in Pahang, a bracelet-shaped tool of brass which has sharpened edges.

This last implement is grasped in the right hand and its sharp edge used for fining down the interiors of bowl-shaped cooking-pots. Small wooden stamps are used for ornamenting Malay pottery and patterns are also scored with a bamboo sliver, or sometimes, I have

Calendering a Malay Cloth.

been told, by drawing a tightly-stretched thread over the wet clay to form a pattern of cuts. Many Perak vessels are fluted, the flutings being added after the pot has been shaped. Occasionally pots are sculptured.

The nature of the material used in potting varies a good deal. Pahang pottery, after baking, assumes a reddish colour, while that from Perak tends to be grey, though it is purposely blackened afterwards. The ware produced in Kelantan is also reddish and contains flakes of mica. Pottery from Negri Sembilan is usually light coloured. Both in Perak and Pahang the clay is pounded before use and impurities, as far as possible, removed from it.

Methods of firing are very simple. In Perak, a small rectangular pit is dug and in this the pots are baked among heaped-up wood.

Perak pottery is built up of successive rings of clay, the upper edge of each ring being thinned off and bent inwards. Pahang water-gourds are made in two pieces, base and top, which are subsequently joined together.

Embroidery. Embroidery is used for a good many purposes. Formerly belts, and sometimes clothes, were covered with elaborate embroidered designs, but nowadays the articles which are most frequently embroidered are dish-covers, pillow-ends, fans, the uppers of slippers, ceremonial mats, hangings, and coverings for water-jars and betel-boxes. One may say that all the finer work is for ceremonial use only.

To-day embroidery which stands out rather strongly in relief is more fashionable than the old style, which was much flatter and, in my opinion, much to be

preferred. Nevertheless really beautiful work is still done at Kuala Kangsar in Perak and in a few other places. The most remarkable embroidered articles still made are the mats and hangings used at weddings of the rich. Most lovely square sitting-mats, generally of two or three layers, but of seven when manufactured for royalty, are still worked at Sayong. Both flat and relief embroidery are to be found on these and touches of fine bead-work are often employed here and there; beads of kingfisher blue being much in favour. The colours of the silks on which the embroidery is done, and which cover the *Pandanus* mat-work, are selected with good taste and the bead-work is so skilfully combined with the gold-thread embroidery that it does not give a vulgar effect.

In the hangings used at weddings small silver discs with flower-like embossing and a fringe of silver "bo-leaf" pendants are often incorporated with the embroidery.

While the flat type of embroidery is often worked in coloured silks and sometimes in "silver" or "gold" thread, relief embroidery is almost always in the two last-named materials. In the case of both types of embroidery gold and silver thread is not sewn through the cloth, but applied and fastened by means of fine stitching with silk or cotton.

Malay women use a four-legged frame when embroidering and, where embroidery in relief is to be done, a cut cardboard pattern is tacked to the cloth and covered with "gold" thread, which is carried backwards and forwards over it on a winder, and securely fastened by stiches at the sides. Pipings are worked over rounded strips of rattan cane which are previously sewn to the cloth.

Where flat embroidery is to be employed a pattern is first cut out in paper and the outlines of this are traced on to the cloth. Pillow-ends and other articles are sometimes ornamented by stitching a cut pattern of gilt paper to them.

Mat-making and mat baskets. It is not easy to give a non-technical description of these two industries and at the same time impart much information. Most Malay women of the villages know something about mat-making, for mats are an essential article of native house furniture and are in daily use for a variety of purposes. There are praying-mats—made and reserved for this use only—sleeping mats, mats of coarser texture with which the floors of the living rooms are covered, as well as rough mats upon which rice is dried, and ceremonial embroidered mats, such as I have described above. The mats which are spread in the living rooms answer the purposes of both chairs and tables, for it is upon them that the Malay sits cross-legged, or squats, and upon them also that his women-folk lay his meals. Hence there is a necessity for clean feet on entering a Malay house, and those who do so, if they be bare-footed, wash their feet at the jar which stands by the steps or, if they are wearing shoes, remove them before entering.

The material of which nearly all Malay mats are made is the leaf of the Screw-pine (Pandanus) cut into strips. Two species of screw-pine are used, one being preferred to the other as lending itself to finer work. Before they are ready for plaiting, the leaves go through a variety of processes including trimming, drying, being split into strips, dressing, pounding, being soaked in water, and a final softening and polishing.

Native dyes are still used to a considerable extent for colouring strips of *Pandanus* leaf when coloured mats are to be made, but even here glaring and much less permanent aniline colours are in favour, and many of the really beautiful mats made in Kelantan are damned by their use.

Malacca Territory is famed for the nested mat baskets made there, while the Malay women of Port Dickson in Negri Sembilan, are adepts in the manufacture of nested baskets, bags and hats; beautiful mats are also produced in the Lipis and Temerloh Districts of Pahang.

The Malacca and Port Dickson nested baskets merit more than passing remark. Their shapes are usually oblong, square or hexagonal, though sometimes triangular. Three to five baskets, which fit rather tightly make a nest; the Malays call their method of construction "crazy plaiting." Their material, *Pandanus*, is self-coloured and when fresh, a light, pretty and silver greeny-grey. Quaint ornamentations of twisted strips of leaf are added to many of the baskets.

The weaving industry. The weaving industry, if it ever flourished there, is almost dead on the western side of the Peninsula, but creditable and often very beautiful work is still turned out in Kelantan, Trengganu and on the east coast of Pahang.

On the west coast, in the few places where a little weaving is still done, and in Pahang, a fixed, two-heddle loom is in use, but in Kelantan and Trengganu a four-heddle loom, with which more complicated weaves are

Laying Warp Threads for Transference to Loom, Winding Thread on to Spools, and Winding Thread from the Skein.

effected. Nowadays aniline dyes are the rule, but here and there beautiful soft-toned dyes are made from stick-lac, the barks of certain trees, arnatto and turmeric.

The Malay skirt (*sarong*) is the national garment of both sexes and women frequently use an extra *sarong* as a head covering, hence cloth for making this article of dress is the material most frequently woven on Malay looms. *Sarong* cloth is not suitable for making other articles of dress because each *sarong* has a broad band of different colour and pattern, called its "head," running through it transversely from top-to bottom. This band, which is worn at the back when the *sarong* is in use, makes the cloth unsuitable for cutting up to manufacture coats or other garments.

The Malay favours checks and plaids as *sarong* patterns and these are, therefore, common designs, though cloths with transverse bars, "Arab pattern," are also to seen.

"Gold" thread cloths are the most beautiful products of Malay looms. In these the background is generally a rich crimson or dark red silk, more rarely creamy-white, and the "gold" thread patterns, the material for which is contained on a number of little bobbins, are worked in among the woof when the cloth is being woven. The best cloths of this type are produced in Sumatra, but creditable imitations are made in Trengganu.

In another type of cloth which is woven in the Peninsula, again chiefly in the north-eastern states, a peculiar tie-and-dye process is applied to the warp before it is placed in the loom. This imparts a curious mottled appearance to the finished product, which the Malays, on this account, call "lime-blossom cloth."

Some cloths, which may be classed as native productions are often not woven in Malaya, but merely decorated there. To this class frequently belong the gold-stamped and "rainbow" cloths. In the case of the former, the material is sometimes a polished silk cloth of Bugis (Celebes) make, or a cotton imitation made in Trenganu. The colour of such cloths is dark blue or black, often with a slight plaid pattern, and they are starched and polished before the patterns are applied. This is done by means of carved, wooden stamps which are treated with gum, the design being built up bit by bit. Gold leaf is then laid on the impressions and, when the pattern is dry, any superfluity is cleaned off and the cloth again polished; this is done with the aid of a large cowry shell fixed to a spring-beam. The European cloths which are printed in Java are also sometimes over-printed in this manner. Gilded cloths are made in Selangor, in Kedah, in Negri Sembilan and in Pahang. The general effect of such cloths is pleasant, but, as they cannot be washed, they are not very practical and are used, chiefly by royalty and nobility, only on high days and holidays.

The basis of the rainbow cloths is often a thin white Japanese or Chinese silk. Patterns are marked on the cloth by means of wooden stamps smeared with a red pigment, and when the design has been thus built up, the patterns are carefully tied up in pieces of the skin of the banana leaf-stalk and the cloth dyed to give it its ground colour. The wrappings are then undone and, as the patterns have been protected against the dye, they have remained white. Any colours which are desired are then put in by means of a brush. In Trengganu the cloth employed is some-

times native woven, for it is not unusual to find that rainbow scarves from that country have "lime-flower" borders. Head-veils for women and *sarongs* are the chief articles made in rainbow cloth and many specimens are said to be produced in Singapore.

A word should perhaps be said about the cloths woven on the four-heddle looms of Kelantan and Trengganu. Some complicated weaves are produced on these machines, though they are subordinate to the pattern and colouring of the cloth.

Nowadays either foreign-spun cotton thread or imported raw or spun silks are used for making Malay cloths, though formerly native cotton and various fibres were made into thread.

Silver work and jewellery. Even in the old days the most skilled craftsmen in the working of gold and silver, such as were maintained at the courts of Malay princes, appear frequently to have been Javanese, though the articles which they made usually followed native Peninsular taste and not that of their own country. Unfortunately the arts of the jeweller and the goldsmith are almost lost to the Malays of the present day. A few old craftsmen linger here and there in the villages and turn out a little work, generally of a very debased type. The Malay worker in gold and silver, for the reasons which I have given at the beginning of this pamphlet, has been unable to meet his Chinese competitor on equal terms. Malay princes now buy jewellery and silverware of semi-European, or European, type in preference to that which follows the ancient styles.

Various articles were made in silver, the most usual being small and larger bowls whose shape is based

on the half coconut shell, small plates, covered bowls, watch-shaped tobacco-boxes which are either round or octagonal, pillow-ends, sets of little boxes to contain the requisites for *sireh*-chewing, tops for clay water-gourds, flat, often leaf-shaped, ornaments for mats and hangings, bracelets, pendants, ear-studs, "fig-leaves" worn as "dresses" by little girls, and other small articles of personal adornment.

As far as the shapes of the articles on which they are used admit, Malay patterns run in concentric bands. Foliate designs are common; representations of animals very rare. The names of patterns and of shapes are very generally those of leaves, flowers or fruits. The lotus, which was, no doubt, introduced as a pattern owing to Hindu or Buddhistic influence in pre-Mohammedan times, is very commonly depicted in conventional forms, though variants of the lotus design are not always recognized as being such by the modern Malays.

The majority of patterns on Malay silver are embossed in low relief, but other ornamentation is resorted to chiefly by the aid of punches.

In addition to plain silver, two kinds of so-called niello-ware are found in the Peninsula. Of one kind the place of origin seems to have been Sumatra, though some specimens may have been made in Negri Sembilan. On viewing the outer surface of a piece of niello of this type, it will be seen that the patterns are in silver, the background being a rich black enamel. The basis of the pieces is silver, and the result was obtained by punching down, or even chiselling down, the ground, so as to leave the designs in slight relief, before filling in with the enamel substance. One presumes that the piece was then fired and any super-

A Malay Silversmith making a Bowl.

fluity of enamel ground off until the level of the silver patterns was reached, when the article was given a final polish. The objects made in this type of niello-ware were usually belt-clasps and watch-shaped tobacco-boxes.

THE other style of neillo-ware comes from the north of the Peninsula. The majority of it is said to have been made in Ligor in Peninsular Siam. The patterns are of different type to those of the Sumatran niello and the articles made are not of the same kinds. Stands, bowls, *sireh*-sets, boxes and caskets and kettles are all found. The patterns are as a rule gilt, though the methods employed in making the ware appear to be very similar to those used in the case of the Sumatran niello. The black enamel however, which is said to be composed of metallic sulphides, appears to be softer and not capable of taking such a high polish. The shapes of the pieces are more Siamese than Malay, while the patterns are foliate and elaborate. Figures of legendary animals are to be sometimes found among the foliage and these, in the newer specimens, tend to become degenerate, the tails, feet and other outlying parts becoming converted into foliate designs.

Another ware which is occasionally to be purchased in the Peninsula, somewhat resembles niello on first sight, but is really of a very different nature. It is an inlay of gold on an oxidized copper ground. Its former *provenance* is uncertain, though the articles made in it, belt-claps and watch-shaped tobacco-boxes, are of Malay style.

I have already said something about personal ornaments of silver, but the subject of gold jewellery still remains to be dealt with.

Silver has always been imported from abroad in the form of coin, ingots or bars; gold, on the other hand, is found in plenty of localities in the Peninsula, though Europeans have never yet been able to make a commercial success of gold-mining. Individual Malay and Chinese gold-washers have, however, won considerable quantities of the metal, and Malay and Chinese mines have been successful in a few instances. It is therefore, probable that a good deal of the older gold-work, especially in the eastern states, may be made of native gold.

Before the coming of the British, the Malay peasant was in most places not sufficiently well off to afford gold ornaments, and this fact together with the frequent remelting of old ornaments to make new, probably accounts for the comparative rarity of old gold jewellery.

Much of the best native jewellery is filigree work, generally on a solid backing, the threads of the "composition," as Malays call it, being ornamented here and there with little balls of gold or with tiny discs of the same metal. These are called respectively "fish eggs" and "pepper seeds." Filigree work is chiefly used for the decoration of pendants, bracelets, ear-studs and rings as well as for the adornment of the mountings of keris-sheaths and as small bosses on silver boxes. Both filigree and *repoussé* gold work are frequently coloured either deep red or a very bright yellow, these results being obtained by means of treatment with chemicals.

Brass and White-Metal Work. At the present day work in white-metal is carried on in Trengganu, and some very fine articles are manufactured. In spite of occasional flaws, which occur

in the casting, the work is good and the finish really excellent. Trengganu whitemetal-ware is without ornamentation of any kind, heavy and takes a fine polish. The usual articles made in whitemetal are *sireh*-caskets, trays, covered dishes, bell-mouthed spitoons, *sireh*-stands of various patterns and stands for glasses.

With regard to brass-ware proper, it is difficult to say how much of the old brass of Malayan type which can be found in the Peninsula was ever manufactured there; but I am of the opinion that very little of it is truly native. Some ancient pieces of heavy, and usually quite plain, brass-ware can sometimes be purchased in the neighbourhood of Pekan in Pahang. These were, probably, either made locally or else in Trengganu, being forerunners of the modern whitemetal-ware.

Other old brass-ware is usually poor in quality and miscellaneous in type, and though the Malays of Brunei and of parts of Sumatra were, and are, most skilful workers in brass, there seems to be little reason to think that the industry ever flourished on the west coast of the Peninsula. When friends speak to me of beautiful old Malay brassware, alluding to articles which they believe to have been made in the Peninsula, I generally say, "There isn't any."

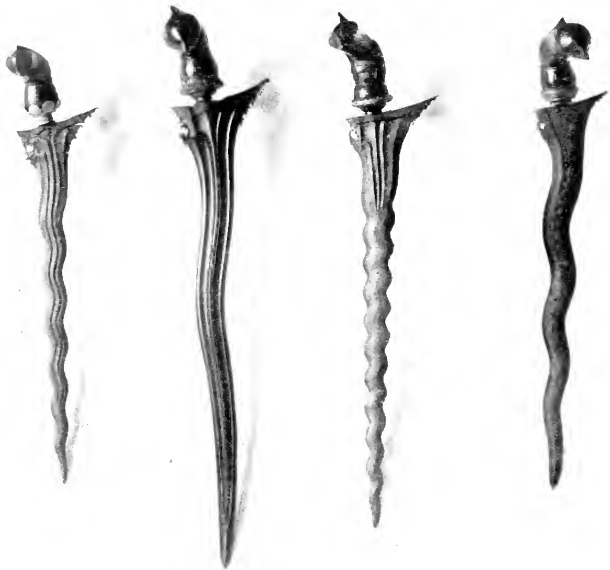
Bronze cannon were certainly made by the Malays at one time, and Newbold says that these were manufactured in Trengganu, in Java, and at two places in Sumatra, one of these being Acheen. He might also have mentioned Brunei, where curious dragon cannon and other types were certainly cast.

The usual method of casting Malay brass-ware is by the *cire perdue* process. A clay and sand solid model of the article to be cast is first made. This is covered with wax, any modelling for patterns being then done. The wax in its turn is coated with clay and sand. It is next run out, the mould being so constructed that a hollow is left between the core and the outer coating. Into this the molten metal is poured, the core and casing being removed subsequently.

The Manufacture of creeses and other weapons. The manufacture of creeses and of weapons in general is a dying industry; in most parts of the Peninsula it is already dead. This is to be ascribed to the present-day security of life and the fact that the wearing of weapons in public is not allowed.

The Malayan region has long been famed for the creese, a type of dagger peculiar to this part of the world. The Malay values this weapon not only for the beauty of its blade, which is frequently damascened, but for its lucky qualities. Some creeses, according to their measurements, are supposed to be lucky in war, while others are good to take on a trading expedition and will ensure the sale of the goods at profitable prices. Another weapon will enable its owner to kill a tiger, if he meets one; yet another will prove useless in such an emergency and will thus bring about the death of its owner.

One could enumerate many types of creese but, in a non-technical pamphlet, much detail is a thing to be avoided. Suffice it to say that the weapon may be short or long and the blade either straight or waved, damascened or plain. The hilt of the weapon, as used in the Peninsula, is nearly always, except in the case



Some Malay Creeses.

of certain long-bladed creeses, given a turn so as to bring its butt end practically at right-angles to the blade. This is due to the peculiar method of holding the weapon in stabbing. The blade, in most types. broadens considerably towards the base and the weapon is grasped pistol-fashion with the flat of the blade horizontal.

Creese-hilts are often fancifully carved. One type is supposed to represent a kingfisher's head, another a man suffering from fever, who clasps his body with his arms. Their material may be wood, ivory, buffalo horn or silver.

The sheath of the creese is invariably built up in three sections made of four pieces. There is the tail-piece, the sheath proper—made of two pieces of wood—which encloses most of the blade, and a cross-piece at the top, made from a solid piece of wood with a slot cut in it to admit the passage of the blade.

The creeses of the rich and of nobles are frequently embellished with silver and gold mounts and casing.

To return, however, to the creese-blades; where these are watered and damascened this has been produced by welding together a number of flat pieces of iron and steel of different origins and by adding some separate ornaments. It is the welds which eventually form the waterings, while the added pieces form patterns down the centre of the blade. The blade is ultimately etched with acid to bring out its structure and treated with arsenic to give it a silvery sheen.

Many other types of thrusting and cutting weapons are found in the Peninsula. Some of them are pretty obviously foreign introductions following the types of Arabic or Indian swords and knives; others appear to be native or introduced from other Malayan

countries, such as Sulu, Celebes, Java and Sumatra. Among the seemingly native weapons is the short dagger which is called a "pepper-crusher."

Damascening is usually confined to the blades of creeses, though spears and other weapons have it occasionally.

Lace making. The industry of making pillow-lace is still carried on at Malacca, where the Malays probably learnt it from the Protuguese. Only small lace edgings, generally coloured, are now made and it is said that the lace products are very degenerate in comparison with those of former days when from fifty to a hundred bobbins or more were used instead of from nine to nineteen, as now.

Wood-carving. Wood-carving again is a dying industry, unfortunately, though here and there craftsmen can be found who still turn out creditable work.

In Negri Sembilan, in the old days, Malays of importance used to have their houses elaborately carved, but this is a thing of the past, though I have seen one beautifully carved modern house near Kuala Pilah. Apart from the adornment of houses, the chief articles which were, or are, carved are clothes-racks used at marriages, straining-spoons, cake-moulds, boxes for storing valuable clothes or jewellery, coconut-graters, the hilts of weapons, and a few other small articles. Trengganu still turns out beautifully carved moulds for small cakes, these being often in the forms of animals, representations of which are somewhat rare among the Malays. In Trengganu the finding of them is due to Siamese influence or to primitive laxity in the observance of Mohammedan law, probably to both.

The four-legged coconut-graters from the north, too, are frequently carved to represent animals, while I have seen a beautiful specimen, with foliate carvings, from Negri Sembilan.

Wood-carving patterns, like those of Malay silver, are chiefly foliate. The designs do not stand out in very high relief, but the work is not usually of the nature of chip-carving. The lotus *motif* can be fairly frequently recognised.

Basketry. The Malays are fairly expert at basket-work, and use it for all sorts of purposes, but very little of the basketry is of high artistic merit. The chief materials used are rattan cane, bamboo and strips of the stalks of a plant which is called *bemban* (*Clinogyne grandis*), while the stems of certain kinds of ferns were used for the finest work. Formerly, fine, round, covered rattan baskets were made for holding clothes, and Malay caps were beautifully woven out of fern stems. This fine work seems, however, to be almost a lost art.

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EDUCATION

IN

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and on

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EDUCATION

IN

MALAYA

BY

R. O. WINSTEDT, M.A., D. LITT.

Malayan Civil Service.

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Education in Malaya.

1. INTRODUCTION.

IN 1823, twenty-three years before any annual grant towards education was made in England Sir Stamford Raffles laid in Singapore the foundation-stone of the Institution that bears his name to-day. On behalf of the East India Company he endowed it with a grant of $300 a month and a large area of valuable land, endowments dissipated as the years went by. The Institution was to have literary and moral departments for Chinese, Malays and Siamese and a scientific department for the common advantage of the several colleges that might be established. It was a fine ideal but undoubtedly it was in advance of the time and the races of Malaya were not ready for such a sudden introduction to higher education. In 1827 the Bengal Government decided to apply the grant solely to the establishment of elementary schools. And not until December, 1837 was the Institution used for its founder's purpose. At first there were English, Malay and Chinese classes. Malays, however, displayed "apathy and prejudice against receiving instruction" and the Chinese pupils fell away, so that these two branches were closed. The subjects taught in the English branch were: English, arithmetic (including book-keeping), history (which comprised outlines of ancient history, together with histories of Greece, Rome, England, and India), chronology, natural history and philosophy, geometry, mensuration, trigonometry, the use of globes, writing and drawing! From 1844

till 1871 the building housed a school for girls. In 1870 a graduate of Cambridge was employed as Principal of the Institution and its modern history began. In 1876 a new wing was built for the sons of Malay rajas and chiefs, who however failed to seek admission. In 1887 the small boarding department, which had hitherto formed part of the Institution, was closed. In 1884 the Trustees contemplated turning the Institution into " a high school for the more elementary schools which have lately increased so rapidly ":—for, already, in 1879 there were six elementary English schools in the city, supported by the Government. In 1889 the Government decided to open a class for physical science and chemistry at the Institution, and classes were started for teaching the various subjects required for the Queen's scholarships to England. Educational progress, however, led to increased expenditure. The Trustees were short of funds. A Commission appointed in 1902 to enquire into the system of education in the Colony recommended that the Institution should be taken over by the Government. This was done in 1903. The Institution became purely a secondary school. It has suffered from a lack of European masters, so difficult to obtain for Malaya, even now when good prospects are offered. Its old pride of place has been challenged by energetic younger rivals. But it still remains the chief Government English School in the Settlement and full of vigorous life. Its history is summarised here as an epitome of the stumbles and falls and advancement of education in Malaya. The differentiation between education in English and education in the vernacular, and between an elementary and a secondary school, the outlining of a curriculum fitted to local needs, the education of girls, the teaching

of science, the provision of a College for the sons of Malay Chiefs, the difficulty of getting suitable masters, the question of Government support, all these are problems that have cropped up in later days, and some of them are still unsolved.

MISSIONARY enterprise, especially, has been responsible for the opening of many schools in the Colony, that have passed long since into the limbo of frustrate schemes. But this short sketch cannot deal with individual schools, Government or aided, past or present, in Colony or Malay States, except such as happen to be peculiarly implicated in the evolution of the educational system of Malaya.

THE growth of that system may be traced broadly in (*a*) the gradual provision of an efficient Education Department, (*b*) the increasing financial encouragement given to Government and Aided Schools, mainly as a result of the representations of that Department, and (*c*) in the development of the curriculum of the schools, on lines of greater specialization and higher proficiency.

2. GROWTH OF THE EDUCATION DEPARTMENT.

IN 1870, shortly after the Colony came under the Colonial Office, a Select Committee of the Legislative Council was appointed to enquire into local education. It found "a great number and variety of schools in the Colony, some purely educational, others combining charity with education," "many under the control of the Roman Catholic clergy, but all, apparently, having a system of their own, unchecked, as a rule, by Government supervision." Lack of

coordinate system had led to much wasted effort and the Committee recommended the appointment of a Superintendent or Director of Schools, who should reside in Singapore. So in 1872 an Inspector of Schools was appointed, whose title was changed in 1901 to that of Director of Public Instruction for the Straits Settlements. For five years this Director still did the work of an Inspector in Singapore, having a civil servant under him as Superintendent of Education in Penang and an educational officer as sub-inspector in Malacca.

PERAK, the premier State of the Federation, had had a schoolmaster as Inspector of Schools as early as 1890. And in his Report for 1896 the Resident-General, Sir Frank Swettenham, remarked that "the advantage of having one officer responsible for education in all the States is obvious." Accordingly in 1897 the post of Federal Inspector of Schools was created, its holder to be an inspecting officer who should interfere as little as possible with local administration.

IN 1906 this Federal Inspectorship was abolished and control of education in the Colony and the Federated Malay States vested in one officer, a civil servant, styled Director of Education. The Inspectors in the four States of the Federation remain officers in charge of State Education Departments to this day, but the new post at once secured a due measure of uniformity in administration and in educational aims. The first move by the Director was to get schoolmasters as Inspectors of Schools for Selangor and Negri Sembilan. The work in those States had hitherto been done by cadets of the civil service, who were not officers of the Education Department and were being frequently transferred. The change

of system created a permanent expert Inspectorate, though it was not till Pahang got an Inspector in 1913 and Malacca an Assistant Inspector in 1921 that every Settlement in the Colony and every State in the Federation had its own local Inspector.

As the schools, English and Malay, grew in number and efficiency, the heavier and more specialized became the work of the administrative staff. The public became more and more keenly interested in the aims of the Department. The Malay Rulers turned to education to equip their subjects to hold their own against the educated Indian and the vigorous intellect and energy of the Chinese. Accordingly in 1916 a new post of Assistant Director in charge of Malay vernacular education in Colony and Federated Malay States was created and, as the comparatively small Education Department could not provide a suitable officer, it was given to a member of the civil service chosen for his knowledge of the Malay language and the Malay mind. This appointment, as the section on Vernacular Education will show, led to a thorough organization of administrative machinery for the betterment of Malay education, an organization not yet rivalled in any other branch of the Department's activities. In the Estimates for 1919 the insertion of another most important new post, that of a Chief Inspector of English Schools, marked on the English side also the beginning of a new phase, when the present Inspectors must tend to become more and more purely administrative officials and the work of inspection pass into less occupied hands. Provision in the Estimates of the Colony for an Art Master and for a Superintendent of Physical Education, officers who will be engaged in training local teachers

and inspecting the work of all schools in their own subjects, marks a further step on the road towards specialization. Finally from 1924 there will be another Assistant Director, (with a trained staff) in charge of such Chinese vernacular schools as elect to apply to Government for grants-in-aid and submit to inspection. Even a perusal of this bare statement of facts will show the great progress of the Education Department on the administrative side since the year 1916.

THERE is no need here to dwell on the poor pay in the past of European and local staffs. It is notorious that before the war the teaching profession was everywhere underpaid. In Malaya there was the further difficulty that the rubber boom attracted away many members both of the European and of the local staff. No salary scheme can be framed to cover the seismic effect of a boom on the economic world.

EUROPEAN male officers are now recruited at the rates for other professional Departments, namely on \$400 per mensem rising by annual increments of \$25 per mensem to \$800 per mensem, while above the time-scale there are five appointments on \$900 per mensem and six on \$850 per mensem. European women teachers begin on \$300 per mensem and rise by annual increments of \$25 to \$500 per mensem. The exchange value of the dollar is fixed at 2*s.* 4*d.* Full pay leave to Europe is at the rate of one month for each completed 6 months' service. Men may retire on pension at the age of 50 and must retire at 55; women may retire at the age of 45.

THE salaries of local teachers are at the moment undergoing revision.

THE sphere of the Education Department is the Colony and the Federated Malay States. Of the Unfederated States, Johore and Kedah have their own Superintendents of Education. In recent years, however, their European Masters have been borrowed from the cadre of the Education Department, which at all times is ready, when asked, to assist any of these States with the loan of officers, with advice or in any way desired.

3. GOVERNMENT AND AIDED SCHOOLS.

BEFORE 1870, the Government of the Straits Settlements controlled neither English nor vernacular education and was content merely to subsidize a few schools. After the appointment of an Inspector of Schools in 1872, schools of two classes were defined: the first, schools managed and financed by Government, which took the fees; the second, schools controlled by private bodies, which received from Government grants-in-aid awarded till 1899 on individual passes. In that year Mr. R. J. Wilkinson (afterwards Colonial Secretary of the Straits Settlements and later Governor of Sierra Leone), drew up a new Code basing grants on the number of children in average attendance, the number presented for inspection and the general standard of efficiency attained. In addition to a principal grant for every child presented, minor grants for discipline and organization were allowed for every pupil in average attendance, and there were grants for needlework in girls' schools and for each pass in an extra subject for pupils who had passed Standard

VII. The Commission appointed in 1902 praised the 1899 Code but suggested a few changes, one to secure efficiency in pupil-teachers and limit their number, and the most important to emphasize differentiation between grants for schools of various grades, an increase in the rate being recommended for the best schools and a substantial reduction in the rate for inferior schools. In 1906 a revision of the Code authorised a principal grant for every pupil not over 10 years of age presented for examination in an infant class, a step designed to weed out over-age pupils and provide money for efficient teachers capable of giving a good ground-work in English. In 1908 another Code was drawn up. Surprise visits took the place of a formal Annual Inspection and only Standards IV and VII were individually examined by the inspecting officer. Grants were based entirely on average attendance and varied according to the grade in which a school or part of a school was placed. The most important point is that one educational system was prescribed for the Colony and the Federated Malay States. In 1914 the Code was further revised demanding a severer test in English. The principle underlying all these Codes was identical. No attempt was made to reconcile the credit and debit sides of the accounts of aided schools. The Government gave grants to encourage certain standards of educational efficiency and laid down rules to see that it was getting value for its money. Grants were annual and paid on the report on a school for the previous year.

THE 1902 Commission found that at that time the expenditure of most schools under private management was entirely or nearly covered by the Government grant and school fees. But even then this

was true only of schools conducted by Missionary bodies, whose members gave their services as teachers for nothing or for less than the market rate. As early as 1878 the High School, Malacca, managed by a Committee of Malacca residents since it had succeeded an old Dutch school in 1826, had been taken over by the Government at the request of the Trustees. The 1902 Commission recommended that Government should take over not only Raffles Institution but also the Free School, Penang, the first school opened in the Colony under British auspices (1816) and free only in the sense that it was open to children of all religions. The Commission found that the staff of both schools needed strengthening, that masters for technical classes were required and that the Free School ought to be largely rebuilt and its play-ground extended. Only Raffles Institution, however, was taken over. The Commission noted that the Chinese of Penang had always supported the Free School in a way that the Chinese of Singapore had never supported Raffles Institution. "When recently, it was found necessary to increase the pay of the masters considerably, the Chinese contributed $32,000, of which $20,000 was invested. This timely help coupled with the fact that the fees were increased enabled the Committee to carry on for the moment, but without constant appeals for special contributions it is feared that the same difficulty will again arise. The teachers compare their pay and prospects with those of teachers in Government employment and are dissatisfied. As in the case of Raffles' the question of pension is the chief difficulty." In 1902 "the Straits Settlements had acquired a bad name in English scholastic circles" and European masters were hard to recruit. Local teachers were worse

paid than Government clerks. Lack of funds led to quite inferior staffs in the aided schools. In 1910 two large Chinese Societies withdrew from the Free School the annual grant of $1,500 which each had given it, because the Government had abolished the Queen's Scholarships and had levied a corporation tax on the funds of the Societies, while the Municipality had imposed a tax for educational purposes. To make up this deficit, the school raised its fees, a measure followed by the two large missionary schools in Penang, St. Xavier's Institution and the Anglo-Chinese School. But financial difficulties increased with the War and in 1920 its Committee handed the Free School over to Government.

TO meet the higher cost of maintenance owing to the War, the Government increased the grants-in-aid given under the Code by 25 per cent. But an Educational Conference held in 1918 resolved " that the Government be requested to give such financial help to the aided schools as will enable them to pay to their teachers as high salaries as are paid to teachers in Government schools and to make provision for adequate retiring allowances." Moreover all the missionary bodies represented individually their financial distress to Government and in 1919 a Committee was appointed to consider the problem.

THE 1919 Committee condemned the old system as limiting the amount of a grant and so of a school's expenditure by the number of pupils earning a grant; as restricting a low grade school to a low grant and so depriving it of the financial means for improvement in staff and equipment; as giving Government only indirect control over the expenditure of its grants, and as a system, which to be equitable would require continual, possibly annual,

revision. It recommended instead that the aided schools should annually submit estimates for the following year and Government contribute monthly the difference between their revenue and approved expenditure, all accounts being audited by the Education Department. It suggested also that Government should consider a provident fund for teachers in such aided schools as applied for its institution. The Colony and the Federated Malay States both accepted these proposals, which, except in the matter of pensions, put the aided school teacher exactly on the footing of his Government colleague.

GOVERNMENT undertook to pay Government rates for the lay staff, to defray the passage money and half pay of European teachers proceeding on leave, rates and taxes on school premises, and the cost of minor repairs, furniture and equipment. The Aided Schools were no longer treated as a cheaper means of providing education than Government establishments, but recognised as part of the scholastic system of Malaya to be preserved for the healthy rivalry and competition they afford. The only item in their expenditure (besides pensions), which remained less than that in Government Schools, was the salaries of Missionary teachers.

THE increase in cost involved by the new system was enormous. In 1921 the amount paid in grants to English aided schools was $529,294 in the Colony and $431,632 in the Federated Malay States. In 1917 it had been $166,450 for the Colony and $115,338 for the Federated Malay States.

IT is hardly surprising that the two Governments began to wonder if they had not been rashly generous. Accordingly in 1921 another Committee

of enquiry was appointed. Its report was a complete vindication of the change. It recommended certain minor modifications to make for smoother administrative working. It suggested that European Missionary teachers, who are graduates of British Universities and devote all their time to their schools, should be paid at Government rates and that Government should defray half-pay leave for missionary teachers. It recommended that Government should pay half the cost of new buildings and of structural repairs to old. And it recommended central classes for the study of science, which entails laboratories and a specialized staff. Appointed to criticize, it found it had to bless the new system.

THE amount of grants asked for hitherto for vernacular schools has been negligible.

4. THE ENGLISH SCHOOLS.

(a). Their Curriculum, Types, etc.

UP to 1891 there were only six standards in the English schools of the Colony: in that year the creation of Standard VII added another year to the course. (It was not until 1908 that the same papers were set for the Standard VII examination in the Colony and the Federated Malay States).

THE only serious secondary work, before the Cambridge Local Examinations were first taken in 1891, was the preparation for the Queen's Scholarships, given by Government from 1885 " to allow promising boys an opportunity of completing their studies in England and to encourage a number of boys to remain in school and acquire a really useful

education." Between 1897 and 1902 these scholarships were awarded on the results of the Senior Cambridge Examination, but from 1903 a special examination was conducted by the Cambridge authorities on lines suited to Malaya's needs, all candidates however having to pass the Senior Cambridge first. In 1900 the Federated Malay States also decided to found one scholarship a year. But a decade later both Governments discontinued the scholarships on the ground that they involved a study of Latin, French and mathematical subjects less suited to local needs than English, and that they led to unwholesome competition and to undue attention being paid to a few brilliant boys at the expense of the rest. It is now proposed to renew them in the Colony at an early date. After their abolition, ambitious pupils began to take the Matriculation Examinations for Hongkong and London Universities and the Singapore Medical College, and the Intermediate Arts and Bachelor of Arts Examinations of London University. To these the near future will add the Matriculation Examination for Raffles College, Singapore.

EVER since 1891 secondary education in Malaya has been associated with the Cambridge Local Examinations. The 1902 Commission remarked that many favoured dropping these examinations, which led to the cramming of a number of useless subjects by boys who should be studying to fit themselves for a Malayan career. But the Commission considered that they had led to a real improvement in English education and that no local certificate would have the same value. The addition of a compulsory foreign language to the syllabus for the Senior Certificate Examination, led to the Education

Department asking in 1916 for a special Malayan Senior syllabus framed to encourage the study of English. In 1919 there followed a special Malayan Junior syllabus. Incidentally, Malay is one of the subjects allowed for these examinations. Thereafter students could take either the ordinary or the special Malayan Cambridge Examinations.

From the beginning of the century the advance of education led to the question if there should not be a division into elementary and secondary schools. In 1902 each of the more important schools combined the instruction of infants, the passing of older scholars through the seven standards, and secondary classes. Time has changed this appreciably. The Government has built many primary schools and in each large centre there tends to grow up a Government secondary school. The strongest tendency is to make a division between (a) Infants and Elementary classes and (b) all classes above them. But the Missionary bodies, which have done so much for education in Malaya, prefer on religious grounds to train their pupils from infancy to adolescence.

There have been many notable developments since the beginning of the century. The direct method of teaching English has become universal. Kindergarten and infant classes have been taken in hand. Elementary manual work is now done in all the best schools. Medical inspection of pupils has been introduced. Due attention is given to physical education, the provision of play-grounds, the encouragement of Boy Scouts, Cadet Corps and all sports.

Notable, too, has been the growth of enthusiasm among every race except the Malay for female educa-

tion. Even ten years ago Chinese parents were loath to send their girls to school. To-day there are Indian and Chinese girls passing out of the English schools to attend the Medical College and choosing medicine as a career.

For the past decade Malays have been growing more and more anxious that their boys shall learn English and they have availed themselves eagerly of scholarships and free places. There is a flourishing Malay College or boarding school at Kuala Kangsar, Perak, to train the sons of rajas and chiefs for official careers: it takes them up to the standard of the Senior Cambridge.

Until recently the demand for pupils from the English schools as clerks was greater than the supply, and a Cambridge Certificate or the Standard VII Certificate was a commercial asset, ensuring a competency in adult life. To-day the supply is growing greater than the demand and parents are beginning to realise that the son of a shop-keeper, for example, may have to seek his living in his father's shop, even though he has done well at an English school. With the spread of English education, knowledge of that language will cease to be an open Sesamé to fortune or even to a livelihood, and one of the gravest problems to-day is to devise for the coming generation types of instruction fitting the young of Malaya for such careers as the country offers. There can be no doubt that the bulk of the inhabitants must turn to agriculture and other industries, and that the Education Department will have to equip them for those paths of life. Any ideal of education, not adjusted to local wants, must lead to economic dislocation and social unrest.

(b). Commercial Classes.

THE 1902 Commission found that shorthand and commercial classes had failed because the great demand for clerks attracted boys away from school, even before they had passed the VIth Standard. It was of opinion that if Raffles Institution and the Penang Free School were taken over by Government, a Commercial Class should be established at each of those schools with a trained master, and it hoped that "merchants will find the advantage of taking boys who have been through the course, and will pay larger salaries than they do to badly educated boys from the lower standards." In accordance with its suggestion commercial scholarships were offered at Raffles Institution as an experiment. In 1904 the local Chamber of Commerce arranged an annual examination and offered prizes. But by 1907 commercial classes had died out in Penang and survived only at Raffles Institution and St. Joseph's Institution in Singapore where they did not attract the best students. In 1910 the rubber industry led to an increased demand for clerks, however poorly qualified, and in 1913 the annual report of the Education Department alludes to an advertisement for 30 boys who had passed Standard IV! In 1913 the Birmingham Chamber of Commerce examined the pupils in the commercial classes of Singapore and Penang. Since 1916 pupils have taken the examination of the London Chamber of Commerce, (except in 1918 when the papers were lost at sea through enemy action). Raffles Institution now gives full courses in commercial subjects, the work is efficient and there is a strong demand from firms for pupils from the classes. No student is allowed to take the course unless he has reached the level

of the Junior Cambridge Examination. Other schools in Singapore and the Federated Malay States teach individual subjects such as shorthand, book-keeping and type-writing. In Penang book-keeping is taught as a form subject in the secondary departments of all the boys' schools and facilities are afforded for learning shorthand and typewriting. There is also a shorthand class for girls at the Convent, Penang.

5. TECHNICAL AND INDUSTRIAL EDUCATION.

In 1902 a Commission appointed by the Government to enquire into English education in the Colony devoted one section of its report to technical instruction. It found insufficient demand for a technical school. Moreover firms preferred apprentices to learn practical engineering in shops, though it was admitted that a preliminary course of mensuration, elementary mechanics, the use of tools, and mechanical and geometrical drawing would be of great use. It urged the equipment of laboratories for Raffles Institution in Singapore and the Free School in Penang and the appointment of a master for each with experience in technical work. It recommended that in view of the demand for surveyors that subject should be taught at Raffles Institution.

In 1917 another Commission (containing no officers of the Education Department) still found the attractions of a commercial career so great in the Colony that it could not advise " large expenditure upon a fully equipped and strongly staffed technical school," but it pressed for the appointment of a qualified

European to superintend "elementary courses in practical mathematics, mechanics and prime motors, drawing and plans, chemistry, physics, electricity, sanitation and hygiene, surveying."

In 1918 a Commission on Technical and Industrial Education in the Federated Malay States recommended the provision of Trade Schools at which instruction should be in Malay, the provision of a Technical School to give training in English, and the provision of an Agricultural School to train assistants for the Agricultural Department and for estates. It emphasized the necessity of improving the pay of technical posts to render them as attractive as the clerical service. It urged the need to make hand and eye training compulsory in all standards of the English schools. A minority Report by an experienced headmaster insisted, however, that there was neither public taste nor demand as yet for technical or industrial education proper.

The above summaries of the conclusions of three committees are evidence that the problem of technical education has not been overlooked by the Government of the Straits Settlements or the Government of the Federated Malay States, though in the face of those conclusions it is not surprising that so far little has been done to develop this branch.

In the Colony in 1902 the Survey Office trained youths to become Government surveyors only. There were also industrial scholarships for which there was so little competition that they were given to any boy, chiefly Eurasians, for the asking: the holders were apprenticed to firms and received

instruction at an evening class. (In 1910 " for the first time for many years " the Penang scholarships found holders!) The recommendations of the 1902 Commission led to Raffles Institution being provided with a science master and a laboratory and for a few years a class flourished, until finally the war robbing it of a master extinguished it. After the war it was reorganized and science has become popular as a subject for the Cambridge Local Examinations. Hand and eye work is now part of the curriculum of most of the schools in Malaya. Evening classes have been opened at Singapore and Kuala Lumpor for teaching Mathematics, Physics, Chemistry, Mechanics, Electricity and Magnetism and Mechanical Drawing.

ONE special institution, the Treacher Technical School, was opened at Kuala Lumpur in 1906 for training apprentices for the Railway and Public Works Departments and later for the Survey Department. Except as a Survey School it was not a success. The clerical service and commerce proved so attractive that it was impossible to get local students or indeed any students of the right type. Soon after the beginning of the war it was closed. Lately there have again come up the questions of restoring this class and of building a Trade or Artizans' School, primarily for Malays who desire to be trained as motor mechanics or fitters in rubber factories. As early as 1897 Sir Frank Swettenham favoured such a school and in 1917 a site was selected and designs drawn up but the great financial depression and doubts as to its success have delayed its birth. In due course Raffles College will supply higher education for students of Engineering and Agriculture proficient in English.

QUITE lately the slump and the consequent dearth of commercial careers for their sons have led Malays and Chinese to evince some interest in technical education: it is felt that conducted on right lines education must somehow be a panacea for economic distress.

6. TRAINING OF TEACHERS.

IN 1901 there was no machinery for training teachers in the Colony except the system of engaging pupil teachers, who were seldom effectively supervised by the managers of schools and who, if they did complete their course, soon deserted a profession, which was miserably paid and the last refuge of the semi-educated unemployed.

ACCORDINGLY the Goverment projected a Training College for male teachers in Singapore, and the 1902 Commission suggested that the Federated Malay States should be invited to send students and bear part of the cost. In 1904 a Training School was tried but no candidates for admission came forward.

THE 1902 Commission also found that useful work was being done by the headmistress of Raffles Girls' School in training female teachers and recommended a training school for them in connection with that girls' school. After discussion that lasted two years training classes for pupil teachers of both sexes were started at Raffles Institution and Raffles Girls' School. The class for girls was so successful that it has lasted down to the present time and been copied in Penang.

THE class for boys was a failure and, following the example of a successful experiment tried in 1905

at Kuala Lumpor in the Federated Malay States, the Colony projected Normal Classes for teachers already engaged in the profession, at all three Settlements. Penang and Taiping got classes in 1907; Ipoh in 1909; Malacca in 1913. These classes are praised as successful down to 1914, when a Commission was appointed to consider improvements in Singapore. It recommended a whole-time instructor and a revised syllabus and spoke of a training school as an ultimate ideal. The war frustrated the first of these recommendations. But the Normal Classes again did good work under great difficulties. The subjects studied are English, Arithmetic, Geography, the Theory and Practice of Teaching, blackboard drawing, general knowledge, and history and the course is theoretically for two years, though many students take longer to pass.

A class for pupil or student teachers, who spent their whole time getting practice in model lessons and attending the Normal Classes, was started in 1914 in Singapore but discontinued in 1922.

In 1918 an Educational Conference recommended sending selected local teachers to Hongkong University, and down to the present day the Governments of the Colony and Federated Malay States give scholarships for 2 to 4 years to promising men who engage to work in a Government or aided school for 5 years on their return.

Proposals to open several Training Colleges for Teachers throughout Malaya have been abandoned, and it has been decided that all shall be sent to Raffles College Singapore, for which a world-wide architectural competition closes at the end of 1923.

7. HIGHER EDUCATION.

(a). King Edward VII College of Medicine.

THE S.S. and F.M.S. Government Medical School was founded in 1905 in response to a petition from many of the leading Chinese citizens of Singapore. In 1912, the name " King Edward VII Medical School " was adopted in recognition of a generous contribution from the Committee of the King Edward VII Memorial Fund. A further change was made in 1921 when " College of Medicine " was substituted for " Medical School."

THE original purpose of the Medical School was to train Assistant Surgeons for the Government, and local practitioners. From the first, however, a full five years' course of training was given and in 1916 the diploma was recognised by the British General Medical Council as a complete registrable qualification entitling its holder to practise in any part of the Empire.

SINCE that year the course of training has been gradually extended and elaborated. The revised regulations of the General Medical Council issued in 1923 have been adopted and the student of to-day receives a complete preparation for his professional career. The standard of licence of the Singapore College will stand comparison with that of any Asiatic school of medicine.

IN May 1923, there were 159 licentiates on the register and at present there are 160 students taking the course. Indians and Chinese predominate, the former in slightly greater number. There are also many Eurasians and a few Malays. Admission to the College is restricted to candidates born or educated in Malaya.

THE school opened with the Principal as the only whole-time officer. Most of the teaching was done by a staff of part-time lecturers, drawn from the Government medical service or from private practitioners. A Professorship of Physiology was founded in 1913, and a Professor of Anatomy in 1920. In 1921 chairs in Medicine, Clinical Medicine, Surgery, Clinical Surgery and Midwifery were instituted.

AT the start, the school was housed in some discarded hospital buildings. A residential hostel was completed in 1916, and a second hostel is now under construction. For several years, the work has been cramped by inadequate accommodation, but new buildings will be finished in two or three years. They will contain laboratories and lecture rooms for two hundred and fifty students. In addition there will be accommodation for post-graduate study and research. A large space has been allotted to the library, and it is hoped, when additional accommodation is available, this department of the College will be of service to the medical community of Malaya.

(b). Raffles' College.

IN 1918 a Committee appointed by Government to advise on a scheme to celebrate the Centenary of Singapore submitted as the most suitable memorial the advancement of education with a view to laying in course of time the foundations of a University. Another special Committee recommended the establishment of a residential College for higher education to be called "Raffles College" and to be the nucleus of a future University. Later the Legislative Council agreed that provided $2,000,000 were subscribed by the public of Malaya and the

Governments of the Malay States towards an endowment fund, the Colony would erect buildings at a cost not exceeding $1,000,000 and give $50,000 annually towards the upkeep. The requisite sum having been subscribed, a world-wide competition was opened in 1923 for a design. Work on the buildings should start in 1924. One of the most important functions of the College will be to train local teachers. It will also give courses in science for students of medicine and agriculture. When funds allow, an engineering faculty is contemplated, and ultimately oriental studies should find a place among its faculties.

GREAT hopes are built on this College by parents ambitious for the education of their sons and daughters. And if the courses of study are framed to meet local needs and the manufacture of a literary class with no practical bent can be avoided, the College should fulfil a want. At the same time it must be remembered that a University education for the few will not materially affect the difficult social problems of a community of mixed races or directly benefit the economic life of the many.

8. VERNACULAR EDUCATION.

(a). Malay Boys' Schools.

THOUGH there had been sporadic missionary efforts to provide schools for Malays and two day schools were supported by Government in Singapore as early as 1856, it was not until after the transfer of the Straits Settlements to the charge of the Colonial Office in 1867 that the local Government took up seriously the problem of building and staffing vernacular schools, where Malay boys should be

taught to read their own language both in Arabic and in Roman characters. At first the Malays were apathetic, jealous of the loss of their children's services and distrustful of secular teaching. The efforts of the native teachers and the use of the schools as centres for the distribution of quinine and other simple medicines helped gradually to dispel prejudice. In 1878 a College for Teachers was started in Singapore and during the 17 years of its life produced the first trained Malay teachers in British Malaya. In 1888 Malay boys who had passed out of the vernacular schools were admitted free into any Government English School in the Colony, a system that with certain modifications is now followed throughout Malaya.

In 1901 a new training college for Malay vernacular teachers was opened in that old-world Malay centre, Malacca. And Malay education received temporarily a great stimulus from Mr. R. J. Wilkinson, a Malay scholar of high attainments, who started publishing Malay classics for the use of schools and created an interest in their own literature in the teachers. But this officer soon left the Department and Malay education progressed on unimaginative and alien lines. Some years later an Annual Report on the Department records: "50 years ago that most distinguished Inspector of Schools, Matthew Arnold wrote: 'The heart-breaking thing is, that what young learners can be taught and do learn is often so ill-chosen. An apple has a stalk, peel, pulp, core, pips and juice: it is odorous and opaque and it is used for making a pleasant drink called cider. There is the pedant's fashion of using the brief lesson time, the soon tired attention of little children.' The horse is a stock subject for essays in

the Malay schools; and invariably the pupils write that the horse is an animal with a head, two eyes, two ears and a nose. One may doubt if the Malay teacher thought of that method of instruction for himself." Still the Training College (Mr. Wilkinson's educational child) did excellent work. And in 1913 another was opened at Matang in Perak.

In 1916 an officer, chosen for his knowledge of the Malay language and customs, was sent to study vernacular and industrial education in Java and the Philippines. As a result of his Report it was decided to build a central Training College at Tanjong Malim, Perak, to accommodate students for a three years' course, and then to close the two existing Colleges that provided only a two years' course. This College was opened in 1922. Meanwhile the curriculum of the existing Colleges was enlarged to include rural science and basketry, and a pass in one at least of these industrial subjects was required for a leaving certificate. It was arranged to acquire land for school gardens and recreation grounds wherever possible. The old-fashioned teacher puffed up with a little learning and full of the old oriental scholar's prejudice against manual labour was ashamed to dig: the new delights in handicraft, and in practical acquaintance with the rotation of crops, the selection of soils and seeds and the study of pests. A series of Malay text-books, dealing with local problems of arithmetic, tropical hygiene, botany, local geography and history and so on, was prepared. Drawing was made a compulsory subject. The revised curriculum "awakened students' intelligence" and the text-books caused the Malay vernacular press to talk of the New Learning. For the first time the Malay was introduced to modern

scientific method and in 1919 the Annual Report on the then still existing Malacca College records: "No student now believes that the Malay classical history of the XVIIth century, the Sĕjarah Mĕlayu, was written by its modern European editor! Nor would any of the teaching staff now require a class to memorize the number of times a day a certain chief of old Malacca administered gruel to his Sultan during an attack of dysentery, though a few years ago that was a question actually set by a native examiner."

THE Sultan Idris College at Tanjong Malim is the distributing centre of knowledge in the Peninsula for those Malays whose education is confined to the vernacular. There will always be a large number of Malay children with no aptitude for languages or literary pursuits, whose mental and moral development will depend mainly on the discipline of the village school with the opportunity it provides for studying the "three Rs," benefiting by physical and manual training, and acquiring such rudiments of simple agriculture as will fit them for the free life of that country-side, where the happiness and economic interests of their race have lain for centuries. From the College trained teachers go out to the village schools to influence the physical mental, moral and economic welfare of the coming generation. That they may not stagnate in their rural surroundings, they will be summoned periodically to vacation classes at their old College. Besides a staff of picked Malay teachers, the College has a staff of European masters including an Agricultural Instructor.

WITH the expansion of all branches of the Education Department's activities it was recognized that the

inspecting staff was inadequate to cope unaided with administrative routine and the work of school inspection. Moreover legitimately enough Malays with an English education were anxious to take part in supervising the work of the vernacular schools. Accordingly Malay Assistant Inspectors of Schools were appointed to Settlements and States to give the vernacular schools their undivided attention. The system has worked admirably. Below them are Malay-speaking Visiting Teachers, who have charge of districts, and below these Group-Teachers, who have charge of the biggest school and supervise the less important schools within a yet smaller radius. Improved salary schemes have attracted the most intelligent type of Malay to the profession of vernacular schoolmaster and it has been laid down that as far as possible they shall always be employed in their native place.

THE improvement in the education of Malay boys has been reflected in the success of those pupils who after passing through the vernacular school in 4 years have proceeded to English schools. Till recently the Principals of English schools dreaded the advent of the average overgrown Malay student, whose intellect had been dulled by years of unintelligent instruction under a village dominie. To-day he welcomes the bright alert little boy, who, given intensive training in English, can jump to Standard V in 2 or 3 years. And as yet the radical reform of Malay boys' schools has only begun to make its influence felt.

(b). Malay Girls' Schools.

MALAY Girls' Schools remain a very hard problem. The unco' guid regard the instruction of girls in

reading and writing as likely to promote love-letters and intrigue. The nervous parent is fearful of allowing girls to traverse streets or paths unaccompanied, while to escort a child to school daily is an exacting task in the tropics. The mother of a family finds her daughters useful about the house. The cynical or self-satisfied parent thinks a girl can pick up cookery and needlework as well at home as abroad. But a great deal depends on the personal influence of the village headman or of the village schoolmaster and it is remarkable how, in some places too small to have a separate girls' school, the forms of the boys' school will be found supplemented by a number of tiny girls.

NEXT there is the difficulty of getting competent school-mistresses. With notable exceptions among the higher classes, women of the older generation can barely read or write and cannot teach arithmetic. Younger women marry as a matter of course and have no wish to take up teaching until middle age has perhaps left them widowed or divorced. A few marry schoolmasters and husband and wife have charge one of the boys' and one of the girls' school, until child-bearing interrupts the wife's scholastic career.

THE Report of 1916 did not neglect this grave problem of female education. The girls' schools benefited greatly from the use of the new series of vernacular text-books. And above all it was decided to engage a European lady to reorganize and supervise the work of these schools. Despite insuperable obstacles, the Lady Supervisor has effected real reforms and caused thoughtful Malays to recognize the need of supporting an attempt to

educate girls to be the intellectual peers of their future husbands. "The curriculum of the girls' schools (1921) is no longer dead and uninspiring. Cookery, clay-modelling, paper-cutting, drawn-thread work, hygiene taught by Lady Medical officers are romantic subjects for the little Malay girl compared with what her elder sisters learnt a few years ago. Needle-work is the most popular subject. Oddly enough the education of Malay girls seems most backward in the matriarchal communities of Negri Sembilan." In 1924 some Malay women teachers will be brought to the centre nearest to their homes and schools for a month or more at a time for a course of training under a qualified Eurasian school-mistress, who will be appointed principal of the most important Malay girls' school in the locality and use it as a practising school.

(c). Tamil Vernacular Schools.

FOR half a century there has been a sprinkling of Tamil vernacular schools in the Colony and as early as 1895 there were two Tamil schools in Perak. They sprang up especially in Province Wellesley (and later in Malacca) where an estate population created a need. All except a few Government schools are under private management but are inspected by Government officials, and such as reach a certain standard of efficiency receive grants-in-aid. In 1922 there were six schools in the Straits Settlements under the supervision of the Education Department (as well as a few estate schools supervised by the Labour Department); in the Federated Malay States there were 122 schools. The great difficulty has always been to get efficient teachers. But in 1922 it is recorded that "estate managers are beginning to recognize the need for the employ-

ment of trained and experienced teachers and on several estates the former teachers have been replaced by teachers trained in India and Ceylon. It is evident that managers are becoming alive to the advantages of providing facilities for the education of their coolies' children, as improvements in buildings, furniture and apparatus have been willingly effected whenever funds are available."

THE latest Labour Ordinance provides that "the Controller of Labour may by order in writing require any employer on a place of employment where ten or more children of any one race betwen the ages of seven and fourteen years, being dependents of labourers on such place of employment, reside, to construct within a reasonable time and maintain at his own expense a school for such children with such school teacher or teachers as shall seem sufficient to the Controller."

IT should be explained that in 1922 there were more Indians than Malays in the *English* schools of the Colony and nearly twice as many Indians as Malays in those of the Federated Malay States.

(d). Chinese Vernacular Schools.

THE enthusiasm for education which is so characteristic of post-Revolutionary China has found an echo among the Chinese of the Peninsula.

THERE have always been in Malaya many old-fashioned schools, run by a man who combined the professions of teaching, doctoring, fortune-telling calling being the fact that he was the one man in and divining, the sole qualification for his pluralist

the neighbourhood able to read and write with ease. The instruction imparted was a parrot-like acquaintance with a few Chinese classics and the use of the abacus.

Since 1911 however the Chinese have founded many schools to give their children a modern education in their own tongue. Some few are free schools maintained by the generosity of individuals; others are run by District Societies (or associations of people from the same district in China) for the benefit mainly of children from their home district; some are run by Christian Missions but most are managed by a committee of enthusiasts who undertake to collect from the public the necessary funds for upkeep. The financial depression of the last two years has adversely affected the income of these schools and the Governments of the Straits Settlements and the Federated Malay States have recently decided to assist such vernacular Chinese schools as voluntarily apply for help, by grants-in-aid.

All but two of the schools are of the primary grade. In their curricula, the Chinese classics are superseded by modern readers, and the art of penmanship, formerly so important in Chinese education, is neglected. The moral teachings of the classics are replaced by text books on ethics, inculcating habits of cleanliness, politeness, industry and good citizenship. In arithmetic, Arabic numerals have replaced the Chinese and text books have been devised on European lines. Handwork, painting and drawing are taught, often with surprisingly good results. The pity is that the Chinese in their craze for modernity are abandoning their own canons of art and ruining their artistic sense by copying inferior European pictures.

The great difficulty with which these schools have to contend in Malaya is the confusion of tongues that results from the many dialects spoken by the Chinese immigrants. A class may contain children speaking two or three different dialects. Fortunately, growing up side by side the children become bi-lingual or even tri-lingual and can usually understand any of the commoner dialects. An attempt is being made to introduce a modified form of Mandarin, the language of Northern and Central China, which its promoters hope will become the national language. It is taught by means of a syllabary of 40 simple symbols, which combined in twos or threes give the sound of a particular character in that particular character. It is too early to say what measure of success will attend this innovation.

English is taught in these schools but with little success.

The policy of the Governments is to encourage in the lower primary classes the teaching in the vernacular of subjects such as georgraphy, handwork, mental arithmetic and so on, which will develop the reasoning powers and so fit children of intelligence for an advanced education in English and other subjects.

9. GENERAL.

(*a*) The public of British Malaya express their views on education not only through the local press but through the unofficial members of the Legislative Council in the Colony and of the Federal Council in the Federated Malay States.

(*b*) In addition there was constituted in 1909 in the Colony an Education Board, composed of four official and four unofficial members, with the following functions:—

(i) to determine the amount of fees to be charged in Government schools, and to receive all such fees;

(ii) to submit to Government the Annual Estimates for educational purposes and to make recommendations thereon;

(iii) to advise the Government as to the purposes for which moneys devoted to education should be expended and upon any matters connected with education which may from time to time be referred to it by the Governor.

(*c*) This Board also receives the proceeds of an education rate of 2% on property in municipalities and 1% on property in rural areas.

In the Federated Malay States the only education rate levied is a 1% rate on property in Sanitary Board areas, which is intended as a contribution towards the cost of English education in those areas.

(*d*) Education in all Government vernacular schools is free. The fees charged in English schools run normally from \$2 to \$3 a month. There are no entrance fees. Free places are given to many Malays and to certain classes of poor pupils of other races. There are also some scholarships.

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A Malay Lady of Perak.

Native Life in the Malay Peninsula.

By IVOR H. N. EVANS, M.A.

IN this little pamphlet I deal with only the everyday life of the native-bred people of the Malay Peninsula, but, for the sake of those who do not know, or have not read about, the country, it is necessary, by way of an introduction, to speak also of the recent foreign invaders of the soil.

Foreign immigration into Malaya. The last twenty to thirty years, and especially the years since 1906, when the boom in rubber began, have seen tremendous changes take place in the Malay States. The population of the western states of Negri Sembilan, Selangor and Perak has increased enormously owing to the immigration of natives of India and China, directly or indirectly, in connexion with the tin-mining and rubber industries, while the islands of the Dutch East Indies, Java and Sumatra in particular, have also added their quota to the population. Probably the greater part of the Indian and Chinese population is floating, and a large proportion consists of unmarried males.

In times of depression this population tends to decrease, for the closing down of estates and mines throws large bodies of Tamils and Chinese out of work, and the immigrant population of the towns is also affected by bad trade. The foreign Malayan (including Javanese and Banjarese) population of

the country is, however, a good deal more stable than the Chinese or Indian. Many members of it take up small holdings, as do also Chinese and Indians, but a considerable proportion of these, especially in the Krian District of Perak, are under rice cultivation, while the Chinese and Indians, except in a few instances, confine themselves to planting rubber or coconuts. The Malayan rice-planter, with his few wants, is almost self-supporting, and is, therefore, comparatively little disturbed by the rise and fall of prices of the chief products of the country. The foreign Malayans being near relations of the Peninsular Malays, and of the same religion, frequently take locally-born wives, while the Chinese and Hindu foreigners cannot obtain Malay wives without becoming Mohammedans.

With the exception of the Chinese shopkeeper and the Tamil money-lender (Chetty), the non-Malayan foreign population has little effect upon the native Malay in his village, but the Chinese petty trader has found his way into every corner of the country and is to be discovered, firmly established, even in the most out-of-the-way places. From him the Malay buys his salt fish, sugar, condiments, rice (if he is not a rice-planter), tobacco, kerosene oil, and other small luxuries and necessities, while he also finances the fishermen on the coasts (much to their detriment) and, inland, makes advances to parties of Malays or aborigines who contract to collect jungle-produce, chiefly rattans, for him. The Chinese rice-miller too will buy, or make advances on, a rice-planter's crop, at a low price, before it is reaped.

The Chetty has also a firm hold on many Malays. The Peninsular Malay, as may be judged from the fact that Chinese do almost all the petty trading,

has not yet learnt to be a shopkeeper, and he is also improvident, which is the Chetty's opportunity. Malays borrow money from Chetties, at interest which works out at about 36 per cent. *p.a.*, since interest on the full amount of the principal is still being paid when many instalments on it have already been refunded. The security, generally a land grant, is ample, and, as the Malay is not a good payer of debts, the mortgagee often forecloses and the land is sold. Owing to transactions of this nature, and the direct sale of their lands by Malays to members of other nationalities, there was considerable danger of them becoming a landless people, which would have been a great calamity, entailing the unsettlement of the only really permanent element of the population. Chiefly for these reasons and to allow for expansion of the Malay population in the future, Government, a few years ago, began to create extensive "Malay Reserves." Within such an area the land may only be owned by Malays and Chetties are chary about advancing money or land situated in a reserve because it has not the same value as that which has a free market.

Malayan as compared with foreign population. At the census of 1911 the Chinese in the Federated Malay States of Perak, Selangor, Negri Sembilan and Pahang outnumbered the Malays, the figures being 433,244 and 420,840 respectively, and it must be remembered that the Malay figures include Malayan foreigners, Sumatrans, Javanese and others. At the same census the Indians numbered 172,465.

At the census of 1921 the Malays had regained the lead over the Chinese the figures being 510,821, and 494,548, with Indians 305,219. The 1921 census

was taken after the commencement of the rubber "slump," and the influenza epidemic of 1918-1919 also adversely affected the population totals.

The exploitation of the Peninsula and its relation to population. The great increases which took place in the population previous to 1911, and, in a lesser degree, since then, have been due to the opening up of the country for mining and rubber-planting, the latter industry being the newer. The face of the country has necessarily changed with its development. Previously, the whole of the Peninsula from north to south was one continuous belt of forest with Malay settlements scattered, or occasionally continuous, along the banks of the principal rivers and their tributaries, then the highways of the country; while small groups of aborigines made their scanty clearings, or roamed, in the depths of the forest. Now, a railway with various branches traverses the western side of the country from Singapore in the south to the boundary of British protected territory in the north, whence it extends, through Peninsular Siam, to Bangkok.

Good roads lead in all directions and, with the exception of forest reserves, but little jungle remains on the western slope of the Peninsula except towards the main range and its outliers. This is still covered with virgin growth and forms the chief stronghold of the Sakai, of whom, as one of the "aboriginal" races of the country, I shall have something to say later.

The unexploited eastern states. The eastern states of the Peninsula have been much less exploited than the western. The State of Pahang is still largely jungle-covered, and in addition, large parts of it are moun-

tainous. Here the Malay population is again found along the main rivers and their tributaries. Kelantan and Trengganu also contain a riverine population and the latter much mountainous country. These three states, too, owing to their unexploited condition, contain a far smaller proportion of foreigners to natives than do those of the west coast.

Parts of the eastern states are at the present day almost in the condition in which the western were twenty-five years ago.

The Pagan Races. The Peninsula contains pagans representative of three races, who, as being earlier arrivals in the country than the Malays, are often termed aborigines, though, in the pure state, the racial difference between the group of which I treat first, and either of the other two, is as great as that between a native of England and a Chinese.

The Negritos. The first group, the Negritos, appear to belong to a very ancient and primitive stock. Their near relatives are the native inhabitants of the Andaman Islands, and tribes of similar people, sometimes called Aetas, of certain islands of the Philippines. There has been a good deal of speculation as to whether they are in any way connected with the pygmy tribes of Central Africa and the Bushmen of the south of that continent, as well as with the pygmy peoples of New Guinea, and with the Negroid race which dwelt in parts of Europe during the Aurignacian age of the Palaeolithic period.

The Negritos are dark brown—rarely black—of short stature and have closely curled hair. The lips are sometimes everted and their facial and cranial characteristics are rightly described as "childish." The skull tends to be rounded rather than long. They are naturally, it is to be presumed, forest nomads, subsisting by hunting and searching for fruits and vegetables, mostly tubers, in the jungle.

Their culture is primitive and their encampments consist merely of wind-breaks of palm-leaves. These small shelters are often separate, but frequently arranged in an oval, while in some cases a rude domed hut, shaped something like a beehive, is constructed, which consists essentially of two shelters facing each other. Small huts on posts are sometimes erected, and occasionally tree-huts are to be found. The former type of structure is, no doubt, copied from the Malays, or from the higher-type "aborigines" with whom they are in contact. Each shelter contains a rude sleeping bench of bamboo and close against this is built a fire, which is kept burning at night to warm the inhabitants. Household implements are few and rice, when obtained, is cooked in large joints of bamboo, if the people possess no Malay or Chinese-made cooking pots.

Male dress consists only of a T-bandage, generally of European-made cloth. The Negrito women of the west coast groups wear curious little skirts of the rhizomorph of a fungus, or of shredded bark. Necklaces of monkey teeth are to be seen, while bamboo combs, decorated with incised patterns, are worn in the tuft of hair at the back of the head, the only part which is left unshaven. The men usually cut the hair short and do not, unless on

An East Coast Fishing Scene.

the occasion of feasts, indulge in much personal ornament. Necklets of the black strings of the above-mentioned fungus are common, and head-bands of tree-bark or fibre are to be seen. Flowers are frequently worn behind the ears.

Apart from spears, the original Negrito weapon appears to have been the bow, which is also that of the Aetas and of the Andamanese. Nowadays, however, its use is almost entirely confined to the neighbouring half-Negrito tribes—to whom I shall have occasion to refer again—while the Negritos proper have taken to using the long bamboo blow-pipe and poisoned darts, the true weapon of the Sakai.

Negrito religious ideas and folk-lore are well developed for such a primitive race. The gods are deified ancestors who now live in the heavens and under the earth, and punish offences by sending terrible thunderstorms accompanied by softening of the ground and the welling up of water from under the earth, involving the destruction of the transgressors' encampment. Attempts to avert threatening storms are made by blood-offerings, the Negritos making slight incisions on their legs near the shin-bones.

The souls of the dead go to a western paradise of fruit-trees on the evening of the third day after death. The occurrence of a death necessitates the immediate desertion of an encampment. Shamanism is found—at any rate among certain groups—and shamans are credited with the power of becoming were-tigers. Shamanistic seances are among certain of the western Negritos—the only sections from whom we have evidence—conducted in a small, specially constructed circular hut, built on the ground, and just big enough to contain the medium

The former range of the Negritos was probably much greater than it is to-day and even in recent times they have deserted places where they used to live. Their present distribution in British Malaya is the north of Perak, Kedah, parts of Kelantan and parts of north-west Pahang, while there may also be some in Trengganu. They extend into Siamese Malaya and have been reported from as far north as Province Chaiya. There is, unfortunately, no doubt that the race is a dying one, and though it is not possible to state their numbers, owing to their being included in the census with half-bred Negrito-Sakai and other "aborigines," the Negritos probably do not exceed 1,000 in the whole of British Malaya. In the State of Kedah, where there are no other aborigines, only 79 were recorded at the last census.

The Negrito dialects present a difficult problem. So far, no correspondence has yet been traced between the language and dialects of the Andamanese and the dialects of the Peninsular Negritos. Both the Philippine Negritos and those of Malaya appear to have borrowed their language from more civilized neighbours—from the Sakai in the case of the latter, or from some former people who spoke a language related to that of the modern Sakai. There are however some elements in the Peninsular Negrito dialects which distinguish them. Both Philippine and Peninsular Negritos have been in contact with the members of other races for hundreds of years, whereas the Andamanese have been isolated and have, seemingly, preserved their own language.

The Sakai. The chief refuges of the Sakai, representatives of the second "aboriginal" race are in the mountains of the main range which

divides Perak from Kelantan and Pahang. In the hills of Upper Perak they have fused with the Negritos, producing a mixed population which appears to me more vigorous and progressive than either parent stock. The culture of these people, though they are now the chief users of the bow, is, on the whole, far more of the Sakai than of the Negrito type, but there is a high percentage of Negrito blood. Going south in the mountains from Upper Perak, the Negrito strain becomes less and less noticeable.

The Sakai is, on average, taller than the Negrito. His hair is wavy and he tends to have a long head, as compared with the round or medium-headed Negrito. His skin colour varies a good deal, but where he is found at his purest may tend to be yellow, or brownish-yellow, and lighter than that of the Malay.

Two theories have been advanced with regard to the origin of the Sakai. One is that the Sakai are related to the Veddahs of Ceylon, the other that they are connected with certain wild tribes of Indo-China. I incline towards the latter view. Their language, though this is not necessarily a guide to racial origin, is certainly related to that of the Mons and Khmers of that region. The Sakai house, like that of the Malay, is raised from the ground on posts. Communal dwellings are found among the Negrito-Sakai of Upper Perak and in the Ulu Kinta, and have been reported in S. Perak, but usually the house is not large. The posts and beams are of undressed timber, the walling of palm leaves or sheet bamboo and the roof covered with palm-leaf thatch. The houses of a settlement are scattered about in the clearing, which is still full of half-burnt tree-trunks and surrounded on all sides by jungle.

Unlike the Negrito, the Sakai is a planter of food-crops. Millet is grown on the higher hills and dry-growing rice is also sown in the people's jungle clearings, but the tendency seems to be for rice to be regarded as a luxury, and quickly consumed, while tapioca and other tubers are looked upon as the mainstay of Sakai diet. Cultivation is of a shifting nature, this being necessitated by exhaustion of the soil of the hill-sides, and the settlement shifts with the cultivation. These are some of the factors which have prevented the Sakai from rising higher in the scale of civilization.

Though the Sakai is a cultivator, this does not mean that he is not a hunter. In fact he is almost, if not quite, as keen a one as the Negrito. Apart from traps and snares of many kinds, in the manufacture of which he is an adept, his chief weapon for hunting is the blowpipe with its poisoned darts. With this he sallies forth in search of game, especially monkeys, so frequently indeed that these animals are rare in the neighbourhood of Sakai clearings. The blowpipe varies considerably in length, according to the district from which it comes, but it consists essentially of a mouth-piece, generally of wood, attached to a long inner tube of bamboo which is the "barrel of the gun," this being covered by a larger, but closely fitting, outer tube of the same material, the function of which is purely protective. The poisoned darts, carried in a bamboo quiver, which has a cover of plaited rattan or of *Pandanus*, are slender shafts of palm-wood, rather thinner than a knitting-needle but of about the same length, or shorter. They have a conical head of pith and their pointed "business" ends are covered with dark, gummy poison. This poison is taken from the Ipoh tree, about which, under the name

of Upas, such curious legends grew up in Europe, report saying that it was so deadly that a near approach to it meant death for man or beast. Other substances, mostly vegetable, but sometimes animal (such as snake poison) or mineral, are often mixed with the venom, but Ipoh sap is always its basis.

In shooting, a dart is inserted into the blowpipe *via* its mouthpiece and a wad of vegetable fluff packed in behind the dart-head. The blowpipe is grasped with both hands near the mouth-piece and the dart expelled by a vigorous puff.

But little evidence has yet come to light with regard to Sakai religion. As among the Negritos the spot where a death occurs is immediately deserted, and the house of the deceased is usually burnt. This is another factor militating against progress among the Sakai.

Shamanism is well developed and the leaders of this cult are credited with the ability of becoming tigers at will. In the Batang Padang District of Perak the shaman performs his rites within a magic circle of rattan which is suspended from a roof-beam within the house and the performance is, in some places, conducted in darkness.

Ideas of a supreme deity exist, but they appear to be hazy. There is some reason for identifying him, or connecting him, with the sun.

The Jakun. The Jakun, or pagan Malays, are to be found in their greatest purity in the south of the Peninsula, chiefly in the State of Johore, but in the states of Negri Sembilan and Selangor on the west, and Pahang on the east, there are numerous aboriginal groups which are of mixed stock, crosses in varying degree between the Sakai

and the Jakun, with the not particularly infrequent addition of Negrito blood, especially in north-western Pahang.

The Jakun speaks the Malay language but in his *patois* are found some words, current in related languages, but not used by the modern Peninsular Malays. The mixed groups are partly speakers of Sakai dialects, partly of Malay, but the physical type seems to be usually more Malayan than Sakai. Their culture is also of a mixed type.

In addition to the Jakun of the mainland, and of the same race, must be mentioned the Orang Laut (Sea People), the sea nomads, who either spend, or used to spend, their lives in their boats. Orang Laut were found on and around Singapore Island on the first establishment of a British settlement and their now much civilized descendants still live in the neighbourhood, though they claim to be Malays, and there has, probably, really been a good deal of admixture of Malay blood. To the same group, too, appear to belong the Selungs of the Mergui Archipelago, off the coast of Peninsular Burma, who are still sea nomads, as well as the inhabitants of certain islands off the coast of Sumatra and perhaps the sea-nomads of Borneo.

The Jakun and mixed tribes are found scattered throughout the territories already indicated. The Mantera (so-called), a Malay speaking group, inhabits Malacca Territory and the adjoining regions, while the Besisi, speakers of a Sakai dialect, are found on the Selangor coast, and coastal groups are also present in Pahang, but the majority of the Jakun are inlanders.

With regard to Jakun culture, it is somewhat difficult to say what of it is natural, and what has been adopted from the Malays, though Sakai

elements are more easily weeded out. Among the mixed tribes of Selangor, Negri Sembilan and most parts of Pahang, the bamboo blowpipe is in use and this must, I think, have been adopted from the Sakai proper. In one small area of Pahang, however, a type of blowpipe is to be found which is unknown elsewhere in the Malaysian region. It is made of two long pieces of wood, grooved longitudinally. The grooves are placed together, so as to form the bore of the blowpipe, the outside is rounded off, treated with raw rubber, or some other sticky substance, and bound round and round with rattan cane. The southern Jakun do not make, or now naturally use, the blowpipe, but imported wooden one-piece blowguns are said to be occasionally found in their hands.

The Total numbers of the Aborigines. The total number of aborigines of all kinds as shown at the last census (1921) was 32,448 for the whole of British Malaya, 27,497 being enumerated in the Federated Malay States. No attempt is made in the census report to show the numbers of the different races separately.

Malays and their origin. Except with regard to their degree of civilization, the Malays stand in regard to the aborigines somewhat in the same relation as the Teutonic peoples of England do to the Welsh. That is to say they are more recent invaders of the country, though old established ones now. At the present day they despise the aborigines as heathens, in their estimation little superior to animals, while they fear them as the possessors of the secrets of magic and of drugs whose uses they have, perhaps, learnt through

association with the jungle animals to whom they are supposed to be akin. In some parts of the country, notably in Negri Sembilan, there has been a good deal of fusion between Malays and aborigines in times past, and this probably is still going on to some extent in more out-of-the-way districts—Malay men marrying aboriginal women, rather than the reverse.

As far as the fragmentary history of the Peninsula can show us, the first Malay settlers came from the once powerful kingdom of Palembang which, in A.D. 1250, according to a Chinese traveller, claimed suzerainty over Kedah, Trengganu, Pahang, Kelantan and Ceylon. Singapore was a colony from Palembang, founded somewhere between 1200 A.D. and 1350 A.D. Both the mother state and the colony perished at the hands of the Javanese in 1377 A.D*. An influx of fresh immigrants from the Menangkabau country of Sumatra, who had matriarchal customs as opposed to the father-right customs of the other Malays of the Peninsula, gave rise, after some fusion with parts of the aboriginal population, to the still matriarchal states of Negri Sembilan—the nine countries.

Through the writings of early Chinese and Arab travellers, the records of embassies sent from China and inscriptions found in Java, Sumatra, South India and in Ligor in Peninsular Siam, we know a little about the early story of the Peninsula, but though it is possible that fresh sources of information, chiefly inscriptions, may be discovered, yet much must remain shrouded in the mists of the past. To my mind, one of the problems which we have to face is: was the whole of the " Malay " population

* Wilkinson's *A History of the Peninsular Malays.*

A Malay Family.

of the Peninsula a back-flow from the East Indian islands? We know that of old, miners visited the country, in presumably pre-Malay times, and the beautifully worked stone implements, which are to be commonly found, seem to bear testimony to a former population, occupying most of the country, which was higher in the scale than the present aboriginals of any of the three races. Did these ancient people disappear, or were they absorbed by the Malay immigrants? Again, how are we to account for the comparatively dense "Malay" population of Kelantan, or of Trengganu and the Patani States of Siamese Malaya, when Johore, Selangor, and even Perak, all of which lie closer to Sumatra—"the original home of the Malays"—had, until lately, a very small population? Of course Kelantan may have been peopled by way of Kedah, but there are certainly reasons for considering that the Malays found some fairly civilized race in occupation of parts of the country on their arrival. Probably further knowledge of the ancient country of Ligor would throw much light upon our present darkness.

The Malay. His appearance. Ethnographically the Malay has been classed as a modified Southern Mongol on account chiefly of his straight black hair, round head, somewhat prominent cheek bones and eyes which are sometimes slightly oblique. He is usually a man of short stature, sturdy and well-proportioned. The joints are fine and the hands and feet small. Stature, however, varies a good deal and Kelantan men tend to be tall, while the people of Negri Sembilan, due perhaps to the admixture of aboriginal blood, are often below the average height, this being about 5 feet 4 inches for men. The skin is usually of a rich, light brown

colour, though variations between very dark brown and light yellow are to be found. Beard is scanty and the body tends to be hairless. The nose is often rather sunken at the root and broad in the nostrils. Probably the Malay is a blend of Mongolian, Indonesian and other elements. There is a good deal of variety of type both among men and women, this being due, I take it, to the mixed origin of the race. Thus small and delicate noses are not uncommon, and strong chins are to be seen, though as a rule they tend to be weak. Hair is normally straightly, but persons with wavy, or even curly, hair can be found.

The popular idea of a Malay. The Malays are a much maligned people. The popular idea of a Malay, in England, seems to be that he is a cruel and treacherous pirate armed with a poisoned dagger called a creese, who is, without rhyme or reason, perpetually "running amuck" among the members of more peaceful nationalities. Some residents of Malaya say that the Malay is lazy and cumbers the earth. As a matter of fact, in some matters, the European could well afford to learn from the Malay, as well as the Malay from the European.

Malay character. The Malay is a somewhat reserved person and, at first sight, might appear to be of a sullen disposition, but a jesting word or two in his own language will usually break up the reserve and produce a smile and, in the young, a flash of gleaming white teeth. Manners are, as a rule, excellent, but in villages off the beaten track you must be prepared to be asked all sorts of questions once the people begin to talk to you,

or you to them. A catechism as to where you come from, what your business is in that locality, where you ordinarily live, what your work is, whether you are married or single and if the former, whether you have any children, and even how much you earn a month, will have to be answered or warded off. Naturally the replies given will furnish a topic of conversation in the village for several days to come.

As compared with those of other races—of the Chinese, for instance—Malay children are singularly orderly, quiet and self-possessed, and a little Malay boy of five years old will be seen strutting along the road with a comical little man-of-the-world air, while Chinese children are brawling and dirtying themselves in the gutter, or occupied in playing some noisy game. It must be added, moreover, that children are seldom beaten or harshly reproved and that if a child says that it does not want to do something which has been ordered, very often no effort is made to enforce obedience.

Malays are inclined to be credulous and tales of the marvellous are readily received if presented in an "appetizing" form. They are a good deal played upon by their "medicine-men," though these professors of the arts of healing by the aid of spirits should not be resorted to by orthodox Mohammedans, such as they are in name.

The Malay has a great respect for his own personal dignity and is extremely resentful of rough usage or of rough methods of address. He cannot bear nagging, or to be made to appear ridiculous before others. At the same time he has a very lively sense of humour and is inclined to indulge in wise saws and terse sayings, to the latter of which his language particularly lends itself.

Young bloods are apt to be somewhat swaggering and self-assertive and in the towns, at any rate, great spendthrifts. It is very unusual for Malays who work for Government, or for others, to ask themselves whether they can save anything out of the current month's pay. What they say is, "Can we make it last out?"

Where the Malay pursues his normal life of rice-planting, extravagance is not so marked. The cultivator does not handle so much cash and is almost self-sufficing, except with regard to clothes and luxuries. The older men, too, are inclined to become penurious, while the better class of Malay peasant women grudges the useless spending of money.

Gambling, cock-fighting and opium-smoking are sometimes connected with Malay extravagance, but opium smoking is generally a vice of the courts and of the rich, rather than of the peasantry, though Patani Malays bear rather a bad name in this respect. Even at the courts, opium-smoking is now dying or dead. Cock-fighting, generally without spurs, still goes on in places, though, as it is discouraged, it is not indulged in very openly. Card games are a common form of gambling.

Many Europeans, as I have mentioned above, accuse the Malay of laziness. Let us examine this statement and see on what foundation of fact it rests, and, if they are lazy, how much it is their own fault.

In the first place, no tropical race can be described as being very energetic, the climate is against it. Secondly, the circumstances of native environment must be considered. The Malay Peninsula has a scanty native population and, at any rate until recently, the struggle for existence, in so far as

gaining a livelihood was concerned, was not severe. It is still not at all so in many Malay districts. Before the coming of the British with their land laws and titles of ownership the peasant opened up a patch of ground whenever and wherever it pleased him and, with little labour on his part—except on first making the clearing—and rather more on that of his women-folk—was able in six months to grow and harvest a crop which would support him for a year. Any small luxuries might be purchased by the sale of any surplus from the crop, or of fowls, fish caught in the streams, or the products of the orchard surrounding his house.

The Javanese, who have some reputation for diligence and are of the same race, are in much less comfortable circumstances than the Malays, even of the present day. In most localities land is difficult to obtain and every foot of it is efficiently cultivated—even the mountain slopes. It is this struggle to gain a living which has accustomed the Javanese to hard work, even as it has the European. It is a case of "get on or get out."

Another factor which has had a good deal of influence on the character of the Malay with regard to diligence is the fact that, in many parts of the country, formerly it was unwise for the peasant to appear to be in too comfortable circumstances. A landed proprietor might be visited by a boat-load of the Sultan's retainers and, if he had rice, fowls, buffaloes and other native wealth, everything won by his labourers might be swept up and carried off, his daughters too if they were pretty, and even his wife. If he protested he would most likely be stabbed in order to cure him of talking too much; so he had to remain silent. I put down the apathy still most noticeable among the Malays of the

Pahang River to memories, or inherited traditions, of the time when it was not worth while for a man to work to make himself comfortable. When a European estate owner or manager says that the Malays are lazy if often simply means, "They won't come to work on my estate, or will only do so irregularly." There is, however no reason why they should, especially if they are landowners. Their land produces enough for their necessities and for their accustomed luxuries. They are in that position of independence which most European hope to reach—their own masters.

As to mental laziness, I have a high opinion of Malay intelligence. A Malay can both think and act for himself in a greater degree than most easterners. The expressions of the children's faces are bright and alert, and where opportunity for exercise of intelligence exists in later life, the level is maintained. Furthermore the Malay is decidedly clever with his hands, as witness the most ingenious traps and snares for mammals, birds and fish which he constructs, the beautiful embroideries and cloths made by his women-folk in certain districts, and the very high degree of skill formerly attained in the working of gold and silver, the making of damascened weapon blades, and in wood-carving.

One or two Malay characteristics I have not yet dealt with. The younger men, especially those of the town, are very keen about taking up new ideas, starting clubs, and so on, but they rarely have sufficient determination, if the matter in hand requires sacrifice of present comfort to insure future gain, to carry things through. Malays quite readily recognize this characteristic and, to do them justice, are quite ready to laugh at themselves about it.

The European is apt to fall foul of the Malay upon one point, and that is with regard to borrowing money, for there is no doubt that he is a borrower, and a skilful one to boot. Requests for loans are so nicely put, that they make him who refuses appear a churl in his own sight, though he may know quite well that the loan, if granted, will only be spent in dissipation, or muddled away. Most Malays would gladly accept a loan to any amount, if they could get it, and without any thought as to how repayment could be made.

The village and its surroundings.

The Malay, in his natural state, is a peasant proprietor and cultivator. The village in which he lives stands in a grove of fruit-trees and adjacent to it are the rice fields, marked out into rectangular patches by the banks which bound the various plots and retain the water when they are irrigated.

The fruit trees of the grove comprise coconut and betel-palms with graceful stems and feathery foliage, tall durian-trees which bear the large spiny and strongly-smelling fruits of whose contents the Malay is so fond, and whose scent has acquired such notoriety. The durian merits further remark, for not only is this fruit beloved of the Malay, but bears and tigers visit the orchards in search of it during the season. The owner either sells the surplus of his durian crop himself—for it finds a ready sale among the Chinese—or lets the trees out for the season for a fixed price. Watchers are stationed in little huts built in the grove, for the fruits are not picked by hand, but allowed to fall when ripe, and then gathered up, though sometimes the branches are shaken with the aid of a long pole.

Other fruit trees are mangoes, rambutans, jack-fruit, mangosteens, langsats and rambais, the mangosteen fruit being considered by Europeans to be one of the best to be found in the country. With the exception of the jack-fruit, the banana and the lime, other kinds fruit seasonally, the main crop, in Perak, usually ripening at about Christmas. The seasons, however, are not well marked, and though there is one main fruiting season, two, or even three, subsidiary ones are common, the same trees bearing fruit twice, while the rambutans in one village may be in fruit in one month and those in another not even in flower.

Of great use, too, to the native is the sago palm, the pith of which produces sago, while the leaves make the best thatch for his house. The leaves of the screw pine or *Pandanus* are manufactured by his women into sitting and sleeping mats, bags for holding rice, open baskets and wallets for tobacco. The bamboo, however, holds pride of place for general usefulness over all other plants and trees. It provides material for fences, bridges, the posts and beams of temporary huts, basketry, fish-traps, cages, traps for wild animals, and many other purposes, while joints of large bamboos are used for holding and carrying water and as cooking vessels, and bamboo sheets, either plaited or beaten out, for walling, and the latter variety for flooring as well. Hard palm wood is also turned to many useful purposes.

The houses of a Malay village are dotted about in the grove without any attempt at regularity. Each is raised from the ground on posts to a height which may vary from about two to six feet. As dwellings in different parts of the country differ considerably in style, it is not possible to give an

A Malay House in Perak.

exact description which will suit every district, but certain features of house construction are more or less common to all, though the house of the poorer peasant sometimes can only boast of a single room. These more or less persistent features are a verandah—either open or closed in—in front of the house, a main room, which may, or may not, be subdivided, and a kitchen, generally at the back. Young girls approaching marriageable age often sleep in an "attic" made by stretching a flooring over the low rafters. Windows are small and are fitted with wooden shutters, often hinged from above.

The upright timberings of the house are of hard wood as are often the cross-timberings which are exposed to the weather, while those which are protected by the thatch and walling are frequently of softer material.

The house walls may be of plaited cane or bamboo, of sheet bamboo, of wood, of tree-bark or of thatch, according to the fancy and resources of the owner and the part of the country in which he lives.

The thatch of the house is of sago palm leaves or, near the coast, of those of the nipah palm, though leaves of other kinds are used in places.

A short ladder leads to the entrance of the house and there may also be a ladder and door in connexion with the kitchen. If the house boasts of a platform at the top of the steps, and in front of the main door, a water-jar will usually be found there, so that those who enter may wash their feet before doing so. If the house has no platform the water-jar will be found at the bottom of the steps.

The verandah is the common sitting and lounging room of the house. Here male guests are

received and a brass tray, or other receptacle, containing little boxes which hold betel-nut, lime, tobacco, etc., for the guests' entertainment are usually kept there. Sleeping mats, belonging to bachelor members of the family, will often be found here, as well as sitting mats, a bird cage and possibly some agricultural implements, bird-traps or fishing nets.

A European, visiting a Malay house for the first time, would be struck by the absence of tables and chairs, for the floor, decorously covered with mats, is the dining table, the bed, and the sitting place. For this reason the feet are washed before entering the house, and no Malay would think of going into a friend's house in European boots, if he was wearing them.

The furnishing of the inner room, or rooms, of the house, if belonging to a peasant, is little more elaborate than that of the verandah—some more mats, pillows, a box containing clothes, possibly a creese suspended against the wall, or a spear, and perhaps a mosquito-net and a mattress.

The kitchen contains a few simple cooking-utensils, a coconut-grater, some wooden spoons and stirrers, two or three cooking-pots of clay or brass, a board for grinding up condiments, a water-jar and dipper, some European or Chinese plates and saucers (or occasionally wooden plates) and some natural or clay gourds for holding water. European cups and glasses are also to be seen, the latter having displaced the old-time half coconut shell, copies of which were sometimes made in silver.

The hearth consists of a rectangular frame of wood containing hard clay and some stones for

supporting cooking pots. It is built on the floor in one corner of the kitchen, and a pile of firewood often lies beside it.

A hole in the kitchen floor serves as a drain down which the refuse from cooking is thrown and all kinds of slops are poured, to form a noisome compost on the ground under the house.

In former days houses were lighted by dammar torches placed in wooden stands, or by open brass lamps containing coconut oil and small wicks. To-day, little tin lamps, burning kerosene, are in general use in the houses of the poorer classes.

Though pigs are not kept, owing to the Malays professing the faith of Islam, and dogs rarely so, for the same reason, the Malay village has plenty of animal inhabitants. Cats of a peculiar Malayan variety, with a short tail with a very marked kink in it, are favourite pets, but the old strain has now become a good deal crossed. The cats are usually painfully thin and live upon plain boiled rice and whatever they can pick up for themselves. Goats, water-buffaloes, hens and ducks all live in, or near, the village. The hens and ducks are often penned up at night under the house, while the buffaloes have a stall of their own in which coconut husks are burnt at night to protect them against the attacks of mosquitoes, to which they are very sensitive. The goats may have a pen under the house or sometimes, as in Negi Sembilan, a separate house of their own, on tall posts with a gangway leading up to it. Precautions to protect animals against attacks at night are necessary, ducks and fowls against the marauding civet-cat, the wild cat and the leopard and their eggs against the monitor

lizard, while the prowling tiger or leopard may attack and carry away a goat, or the former a buffalo.

Other animals to be commonly seen in the villages are tame monkeys. The Pig-tailed Macaque and the Crab-eating Macaque are both kept to pick coconuts, but the former, a nasty-tempered and evil-looking brute, is more commonly employed than the latter. Well-trained monkeys are very clever at selecting and picking the ripe nuts.

Malay occupations. As mentioned previously, the Malay is essentially a peasant proprietor, and except where he has taken up land to plant rubber, and relies upon this for his livelihood, he remains a padi-cultivator, though near the sea fishing tends to be the chief occupation of the native population.

Both wet and dry-growing varieties of rice are cultivated, the former always on the flat—for irrigation of terraced highlands is not practised in the Peninsula—the latter generally in clearings on the hill-sides, but sometimes, and particularly in some districts, on flat land as well.

In planting wet rice a nursery is first made in which the seed is sown thickly. The nursery is prepared so that the seedlings shall be ready to be transferred to the fields when these have been flooded ready to receive them. The preparation of the fields is governed by the advent of the rainy season. In the north-west of the Peninsula planting-out usually takes place in September and October, harvest in March or April.

The method of cultivation of the fields varies in different localities. In some a simple wooden plough, shod with iron, is used to break up the soil

and kill the rank growth of weeds and grass which springs up in the fields after harvest; in others a peculiar implement, a heavy blade set at right angles to a long wooden handle, is used with an underhand swing to cut down the grass, while in Negri Sembilan a wooden hoe takes its place. Harrows are used after ploughing to remove the weeds, and where other methods of cultivation are employed the weeds are also drawn out of the plots.

When the grass has been cut or ploughed, some water is admitted through a breach in the bunds which surround the patch, so as to kill off any roots which may be left and to soften the soil. The field is often further prepared by driving a buffalo round and round, which drags a heavy, fluted wooden roller behind it. A still simpler method of preparing the soil is to loose a herd of buffaloes in a field and make them do the work of turning up the ground by driving them continuously over its surface.

When the fields are ready, the soil in them having been reduced to a semi-liquid mud, the seedlings are planted out in rows, their roots having been previously cleared of adhering earth and their tops trimmed off. The planting out is done by the women and frequently only the hand is employed, but a small wooden dibble is also used, and in some places, a curious pronged instrument, held in the right hand, with which the seedlings are removed from a bunch in the left hand, and thrust into the ground. Some Malays, however, say that this implement, which is called the " goat's hoof " damages the seedlings, and do not use it for that reason.

As soon as the seedlings have been planted out in rows, more water is admitted, until it reaches

about half way up the stalks; when it is shut off. Water is retained in the plots till the rice comes into bearing and the fruit shows signs of ripening; then the land is drained.

Reaping is done chiefly by the women and a curious form of knife is used, which necessitates the cutting of the crop ear by ear. Malays dislike a more wholesale method of reaping as they say that if they use a sickle they reap unripe heads as well as ripe, and also that the soul of the rice would desert them as, where the sickle is used, the grain is afterwards roughly beaten out of the heads at the ends of their long stalks. The Malay method of reaping is to cut through the stem close under the ear, and the grain is subsequently trodden out with the feet.

Dry-growing rice is largely planted in jungle clearings on hill-sides. No nursery is made in this case, the grain merely being sown in holes made with a long dibble. Such a clearing will not give a good rice crop for more than one season, though it may be used for another year or so for planting root-crops, such as yams and for growing gourds, bananas and chillies. Rice is often stored in a little out-house near the house proper.

Second to agriculture as a native occupation, comes fishing, since a considerable part of the coastal population depends upon this pursuit for a livelihood, while the riverine Malays engage in it as a spare-time occupation, partly to supplement their food supply, partly as a sport and partly to supplement their incomes by the sale of their catches.

The methods of taking fish employed by the fisherman of the coast are many and various, including fish-spears, hand-lines baited and weighted

for fishing in deep water, spinning baits, casting nets—used only in shallow water—drift nets, seines and fixed purse nets, but the stake-traps which are to be seen, often far out from the land, in the shallow Straits of Malacca, are the most noticed by the hasty visitor to Malaya. These erections are of considerable strength. They consist of two lines of stakes converging upon a stoutly-built rectangular cage, open at both ends. When this type of trap is working; a carpet-like screen of roughly the same dimensions as the interior of the cage, is let down into the water. This is depressed at the mouth of the cage and in the middle, but raised towards the edges, so that the fish shall not escape. When a shoal of fish is observed to have entered the cage, the watchers on the platform above raise the screen by means of two windlasses, and the catch is bailed out by means of a landing-net, or scoop, attached to a long pole. The trap is then re-set.

Other stake traps which are to be seen along the coasts consist of two converging rows of poles leading to a series of heart-shaped compartments, the base of each heart, *i.e.* its broadest part, being directed outwards and there being narrow entrances leading from one compartment to another. The compartments of the trap are walled with screens of bamboo or other material, and the fish find their way along the stakes and into the first division, and from this into the furthest. In the larger traps a door is closed on the fish when they have gone into the furthest compartment and a submerged screen, which forms a floor, is raised to allow of the fish being scooped out by means of a bailer on a long pole.

Fishing in rivers, pools and small streams is much indulged in and many methods are employed. The cast-net is very popular and many kinds of ingenious traps are to be found. Fish are also caught by stretching a rope, to which white streamers are attached, across a river and dragging it down-stream towards the entrance of a large trap. Fishing rods, too, are used and rough reels are often attached to them. Various forms of rod-fishing are found, including spinning and a sort of fly-fishing with a live grasshopper or other insect. Night lines, sometimes baited with small fry, sometimes with fruits, are a favourite method of catching large fish. Night lines may, or may not, be attached to rods the butts of which are driven into the river bank.

The draining of small ponds, the damming of small streams, and drawing off the water from the rice fields, are all methods used for catching fish, and a vegetable fish poison is also employed, the roots of the plant which produces it being pounded up with water and the resultant fluid turned into a stream.

Except where fishing is undertaken on a commercial scale, it is a spare-time employment, or a profitable amusement, in which the Malay will indulge when the padi does not need his attention, or in the slack season between harvest and planting.

Hunting and trapping, except in the case of a few professionals, also come under the same heading of spare-time employments, and here again the traps show great ingenuity in their construction. Snares, nooses, pit-traps, spring-traps armed with spears, are all used with effect for mammals, while bird-lime and decoys are among the favourite methods of taking birds.

Malay women, as those of other nations, are largely occupied with the care of the house and their children, but they also find time for other employments besides these two and the planting, tending and reaping of the rice. They make the *Pandanus* mats which cover the floor of the house and which also serve as beds. In Malacca Territory, and around Port Dickson, they are skilled basket-makers; while in parts of Kelantan, Trengganu and Pahang there are colonies of Malay women who are skilful weavers of cloths of various kinds, both silk and cotton. Embroidery, at which the women of Kota Lama, near Kuala Kangsar in Perak, excel is another spare-time occupation, while lace-making—a Dutch or Portuguese-introduced art—is in vogue around Malacca.

Malay dress. The full dress of the Malay man, at the present day, consists of a pair of loose Chinese trousers, a tubular skirt (*sarong*) rolled up around the waist to leave a greater or lesser portion of the trousers exposed, and a loose, sleeved coat, which is buttonless and is donned by slipping it over the head. There is a V-shaped opening in front and this is secured above by a fastening of some kind. To appear in public, on ceremonial occasions, wearing only trousers, or only a sarong, is considered impolite, and in Pahang the wearing of a sarong only is considered effeminate. In the western states, however, the sarong is frequently worn without trousers or any underclothing, and trousers without a sarong. The proper Perak custom is that only royalty and chiefs should wear the coat tucked in under the sarong, but this custom is now largely disregarded.

Formerly the headdress for men was a patterned cloth tied in various fashions, but this has in almost all places fallen into disuse, except among the elderly and on ceremonial occasions, its place being taken by a short cylindrical cap of coloured velvet, the effect of which is distinctly smart. A little white skull-cap is worn by those who have aspirations to be considered pious, and returned Mecca-pilgrims, *haji*, wear a turban bound round the head in addition.

A conical sun-hat of palm-leaf and rattan is worn by workers in the fields.

Men cut their hair short, or shave the entire head. Women dress their long, dark tresses in a variety of ways.

As I am only attempting to describe the daily life of the common people at the present day, I will make no reference here to the wearing of weapons nor to obsolete articles of clothing. Furthermore as my description is intended to strike an average I shall not refer to manners of dress in favour among only small sections of the population, such, for instance, as the immigants from Siamese Malaya who have settled in northern Perak.

Present day womens' dress consists of a sarong similar to that worn by men-folk, but often of more ornate design, which is draped to hang to about the level of the ankles. Flowered sarongs, printed in Java, are in favour with the women, though check and tartan patterns, such as are used by the men, are also commonly worn.

The type of jacket which is now very generally used by women is a long coat of Portuguese origin, which is fastened by a set of large brooches, three in number. Its material is usually a flowered cotton or silk cloth. Short jackets, either open down the

front and fastened with small buttons, or having a hole in them through which the head is thrust are also commonly to be seen.

As the Malays are Mohammedans, a head-covering, with which the face can be veiled, is a necessary article of female attire, but the Malays' interpretation of the law of Islam on this subject is somewhat liberal. In some states a second sarong is commonly worn over the head and shoulders, and this, when necessary, can be pulled close over the face so that little of the features can be seen. A loose veil, thrown over the head, with ends hanging down in front, is also popular in other parts of the Peninsula. In Kelantan, woman's dress consists of a sarong as a skirt, a strip of cloth round the bust and a floating veil.

With regard to the jewellery worn by both sexes, it is nowadays difficult to say what distinctively native articles are still in use, and even such as are now worn chiefly by Malays are sometimes of foreign origin and nearly always the work of foreign (Chinese) craftsmen. Almost any article of jewellery is acceptable to the modern Malay woman, though if she be of the town, she despises the old-time ornaments of her people. Even the village women have stopped wearing the large brass, silver or gold belt clasps; the large silver (virgin's) ear-studs; silver rings, bracelets and anklets; filigree pendants and silver beads and scent-boxes worn tied to a corner of the handkerchief. Necklaces of large gold, or gold-washed, beads, either decorated with, or composed of, filigree work are still to be seen, while the peculiar brooches, seemingly of foreign introduction which are used with the long coat, are universal.

In Perak, anklets of Chinese make and composed of an alloy of copper, gold and silver are in use to a certain extent. Heavy silver, or more rarely gold, hairpins are to be seen, but these generally follow Chinese patterns.

Men's jewellery of the present day needs little description. Formerly silver watch-shaped tobacco-boxes and gold and silver rings of native manufacture were in use; to-day the tobacco box is no longer seen and the ordinary European signet ring is affected by those who can afford one.

Food. The diet of the average peasant is poor, consisting as at it does of boiled rice, a little fresh or salted fish, with some chillies ground up with salt to give it a relish, and perhaps some cooked vegetables, such as fern-shoots. Meat is rarely eaten except on the occasion of feasts. Native fruits, sugar cane, Indian corn, glutinous rice cooked in bamboos with molasses, or in other ways, flaked rice, popped rice, durian preserve, curds made from buffalo milk, a semi-decayed paste made from pounded shrimps, and introduced luxuries like white sugar, onions, dried tamarind fruits and coffee form welcome additions to the menu.

During the fasting month cakes of various kinds, most of them not very appetizing to the European palate, are made, and are consumed between sunset and sunrise.

Buffaloes, goats and fowls are slaughtered on ceremonial occasions, as at marriages and circumcisions, at the end of the fasting month and when payment is made of some vow or other. The flesh of the animals is converted into most tasty curries of many varieties, but, to the European, buffalo-meat, unless from a calf, appears horribly tough.

Glutinous rice, coloured and flavoured with turmeric, is also much in evidence at ceremonial feasts. Steam-cooking is in common use and glutionus rice is often cooked by this method.

Coconut oil is used for frying fish, fowls and banana fritters and the juice expressed from coconut pulp is plentifully employed in making Malay curries, which are liberally flavoured with cinnamon, cloves, turmeric and many other spices.

Amusements. Many of the old-time native amusements are gradually falling into abeyance. Once, fights between buffaloes, buffaloes and tigers, and between rams were held on great occasions, but they are now so rare, being either forbidden or discouraged, that I think myself lucky to have been present at both a ram fight and at a contest between two buffaloes; neither event was at all exciting.

Cock-fighting, with or without artificial spurs, was at one time much indulged in, but now the Malay generally has to content himself with fights between such small game as doves and quails. Betting on sporting events is always in evens.

One would not, perhaps, be far wrong in placing the attendance at ceremonial feasts in connexion with circumcisions, marriages and burials, among amusements, as well as the parties for singing religious verses which are so popular.

Of games played by adults, football with a wicker-work ball certainly deserves mention. The players stand in a circle and the object is to keep the ball in the air as long as possible. Kicking is with the inner side of the foot and ankle, and a

guard of palm-spathe is often worn to protect the foot from injury. The knee is also used to propel the ball.

Kite-flying is another amusement in which adults indulge, though it is much in favour with the young as well. The kite-flying season is after harvest, when strong winds prevail. Where contests take place, the strings of the kites are covered with powdered glass, stuck on with glue, and the object of each man is to cut another's kite-string. Kites are of many fanciful shapes and are without tails. An automatic instrument of bamboo and rattan, attached to the kite, makes a humming noise when the kite is in the air.

In Pahang a curious pastime, a sort of conquerors, is, or was, in favour among the upper classes, and it is said that sometimes considerable sums of money are lost and won in betting. A hard fruit of a special kind is placed in a peculiar type of press, which is slightly reminiscent of a lemon-squeezer. When the press has been secured by means of a bolt, a sudden blow is given with the heel on the part of it which encloses the nut. If the nut breaks its owner loses.

Top-spinning contests are also much favoured. The Malay top is spun by a tapered cord wound round its upper part.

A curious boxing dance, if we may call it so, is still in vogue, in which the two male performers, after numerous posturings and passes, come into contact, when blows are given, warded off and returned before posturing is again resumed. There is often a musical accompaniment to the performance and drums play a prominent part in this.

Dances with singing, in which there is a good opportunity for the display of wit in the verses which are bandied to and fro between the male and female partners, are much appreciated. In all Malay dances posturing and the movements of hands and arms are quite as, or even more, important than the movements of the feet.

In one form of dramatic performance, which comes from the north, there are often a prince, a princess, a clown who wears a ridiculous mask, and an ancient female attendant. A good deal of humorous dialogue, usually rather coarse, ensues and dancing also forms a part of the entertainment.

The Malay "opera" of the towns, with its weirdly painted scenery and its still more weird costumes, is not a native product, but even here some native touches survive, and the fooling of the clowns, of whom there are usually two, is often excellent. Such pieces as "Hamlet" and the "Merchant of Venice" are played, but they would be unrecognizable to a western audience under their Malayan guise.

Indoor games for grown-ups are cards, chess and draughts, while children have variants of our games of marbles, hide-and-seek, leap-frog and some curious games in which the principal performer is said to be in a more or less hypnotized condition.

Religion and Superstition. As in many other countries, religion and superstition in Malaya are intimately interwoven. The Malay is nominally an orthodox Mohammedan, but he has never yet been able to free himself from the doctrines of his Hindu religious teachers, who preceded those

of Islam; much less of the older beliefs and customs which he probably brought with him into the south from the original cradle of his race.

A good deal of village life centres round the mosque, an unpretentious building with a double-tiered roof and wallings of wattle, wood or bricks and plaster, according to the wealth of the neighbourhood.

The weekly religious service is on Friday, but the average villager is no Sabbatarian, though he attends the midday service once a week. Friday prayers in the mosque cannot be legally offered up unless there is a quorum of forty-four adult males. Females do not attend mosque. In some districts fines are imposed on members of the congregation who are absent from mosque on three successive Fridays. Festival services are held on the day after the fasting month ends and on the day on which the Mecca pilgrims complete the pilgrimage rites.

A large single-ended drum, made from a section of a hollowed tree-trunk covered with skin at one end, hangs in a verandah which encircles the mosque. This instrument is beaten to call the faithful on Fridays and also at the time of the five daily prayers. The call to prayer is given by the "sexton" after the drum has beaten.

Though Friday prayers are almost universally attended in the villages, the five daily prayers are much neglected. Only those who have some aspirations to be considered learned in the law and in religion, their children, and some elderly persons of both sexes keep the appointed times, but the observance of the rule varies from district to district. The daily prayers are said in the house or in the mosque, or even beside the highway. Prayer-houses, smaller than mosques, where no weekly

Malay Ferry-boat on the Perak River.

service is performed, are also commonly to be seen. A river, a well or a tank is to be found adjacent to every mosque. Here the faithful perform the necessary ritual ablutions before entering the building for prayer.

The fasting month is well observed in the villages and smoking, chewing, eating and drinking are not indulged in between sunrise and sunset.

With regard to the Pilgrimage, Malaya sends a larger proportion of her population than do other far richer countries which are nearer to Mecca.

I have already alluded to the Malays' trust in "medicine-men." These practitioners work largely by means of spirits. In their invocations they may call at one minute on Allah and on the Prophet, in the next on a Hindu deity and almost immediately again on the ancient spirits of the soil or of the jungle. Thus a large proportion of Malay spells have an orthodox Mohammedan beginning and ending, while their body is entirely heterodox—animism strongly tinged with Hinduism.

Besides carrying about on him charms against disease or misfortune, to gain him the love of women, or to make him beautiful, the Malay resorts to magic, rather than to religion, on all occasions when he is in real danger or in spiritual difficulties. Tempests at sea can be quelled by the repetition of magical formulae game captured or killed; protection against evil spirits insured; beauty attained and the love of women secured.

The new-born baby must be surrounded by such objects, including iron, as will dispel evil, while thorny plants are placed on the ground under the house where a woman is in childbed with the object

of entangling the trailing entrails which stream behind the flying head, the spirit which preys on women who are in this condition.

Iron, though used as a protection for a child in its cradle, must not be brought into contact with it at birth and the knife with which the navel-cord is severed is always of bamboo. A bamboo knife was, no doubt, the primitive implement used before the introduction of iron, which from the wonders which it could perform, was accounted a magical substance. The belief, therefore, grew up that iron should not be used at birth as the child's spirit, being yet feeble, might be frightened out of its body. Ancient custom, too, had most likely something to do with the preservation of the bamboo knife.

Animistic ideas, again mingled with a certain amount of Hinduism, are to be found in the rites connected with the cultivation of padi. As in many parts of Europe, the soul of the crop, enshrined in several ears which are reaped separately, is carefully taken and preserved.

Birth, Marriage, Divorce, Death.

The Malay baby, on its appearance in the world, has to undergo many annoying attentions. It is spat upon to protect it from evil spirits; "his resting-places" to quote Wilkinson's pamphlet, "are smeared with sacrificial rice and with cosmetics that no ghost can approach; his cot is fumigated with the incense that the devil is known to abhor; his bath contains potent ingredients (such as manganese dust and talismans of all sorts) that makes the water purifying both to soul and body." He is also instructed in the Moslem religion, has his mouth "opened" with a gold ring, his head shaved ceremonially and is introduced to the spirits

of the river with ceremonial offerings, and finally cradled. All these ceremonies, and others, take place during the first forty days or so after Mr. Baby's birth. So it will be seen that he does not have a very easy time.

Malay boys all undergo circumcision, which, in the Peninsula, is regarded as signifying full admission to the Mohammedan community, though, as a matter of fact, circumcision is nowhere enjoined in the Koran and, according to orthodox teaching is only one of those things which are "fitting." The operation is usually performed after the boy has undergone religious instruction, somewhere between the age of seven years and puberty. Girls have to submit to an operation of a similar nature, but at a much earlier age. Other ritual, but non-Mohammedan, mutilations are the filing down of the front teeth in both sexes at maturity and the piercing of girls' ears for maidens' ear-studs, this being done while the children are still small. The teeth used to be blackened, but this custom is now obsolete.

In the marriage ceremony Mohammedanism is comparatively little in evidence, for though, from the orthodox point of view, the formal offer of marriage and its acceptance, at which is also stipulated the amount of the marriage-settlement, or bride-price, are the essential part of the ceremony, to the average Malay the non-Mohammedan ceremonies are at least equally important, possibly more so. The chief of these are the sitting together of the couple on a raised dais in view of the guests, and the ceremonial feeding of the man by the woman with three mouthfuls of rice, and *vice versa*, but the whole marriage ceremony, which goes on for several days, consists of a mass of rites including ceremonial bathings, shavings, henna-stainings,

often a mock combat, and the binding and breaking of a cord. The bridegroom is regarded and treated as a (temporary) king.

Marriages are arranged, with many formalities, between the parents or near relations of the contracting parties, and a present of *sireh*-leaves and of two rings is carried to the house of the bride's parents.

Whether the suitor, who does not appear in the negotiations, has seen his intended bride before the ceremony takes place depends a good deal upon the part of the country to which he belongs. In some neighbourhoods young girls are a good deal more shut up than in others, but in the more particular districts the young man often manage to get a glimpse of the girl through a chink in the walls or flooring. It is only at a girl's first wedding—the bridegroom may or may not have been married previously—that much ceremony is indulged in. The Malay, as a Mohammedan, is legally allowed the use of four wives at the same time and as divorce is easy for the man, an unsuitable wife is frequently put away and replaced by another. A "widow" thus made frequently remarries after a few months. Very few Malay peasants support more than one wife at a time, but many young men marry several times before they finally settle down—and even then! There are three degrees of divorce, the third being final and no man can remarry a wife to whom he has given divorce in the third degree unless she has been married to somebody else first. In order to circumvent this Mohammedan law, husbands who have given such divorce to their wives, and repented of it, sometimes get another Malay, who is technically known a "blind Chinaman" to marry the divorced wife and then divorce her

again in favour of the late husband. The objection to this proceeding, from the husband's point of view, is that the marriage of convenience must be consummated.

When the Malay becomes ill the medicine-man steps in to attempt his cure by means of spirits, the native doctor by drugs and the religious by the aid of prayers and water in which texts from the Koran have been steeped, but should matters proceed to an extremity the dying man is handed over to the care of the religious authorities of the village who are with him in his last hours. Perhaps only at death do animism and Hinduism release their hold on him.

The bodies of the dead are carried to the grave-side by numerous bearers accompanied by chanting mourners. The corpse is buried in a side-niche dug in the grave wall. Two tombstones are finally erected over the grave, one at the head, one at the middle. This custom is not orthodox, I believe, for I remember that on one occasion when I was in Negri Sembilan, some of the religious, much to the annoyance of the local Malays, had been pulling up one gravestone on each grave, leaving only that at the head. Stones or posts marking women's graves are flattened, those on men's cylindrical.

Various. Before bringing this pamphlet to a close there are yet a few matters which it may be worth while to mention. My object has been to describe succinctly the life of the average Malay peasant, not that of the nobility and royalty, but a few words concerning these two classes are perhaps necessary.

Malay sultans like to trace their descent, though not all can do so, from a legendary prince Sang

Saperba, who is said to have appeared on a mountain in the interior of Sumatra and to have founded the Menangkabau line of kings. He is stated to have been a direct descendant of Alexander the Great!

Nominally Malay sultans were absolute: actually the power of the territorial chiefs was very great, as was also that of the custom of the country. In Negri Sembilan, where old customs retain much vigour, the form of government was almost democratic.

In former days the sultans and their chiefs lived largely upon export taxes on tin, which were collected at the mouths of the larger rivers. They also made their subjects work for them for nothing. Thus if a reigning prince wished to build a new palace, the men of one village would be told off to cut the necessary timber in the jungle, those of another to dress it, of a third to erect the posts, and so on. Padi was also planted by the aid of forced labour and, in war, the man-at-arms had not only to fight without pay, but to bring his own provisions with him. Other sources of revenue, chiefly in later years, were the letting of opium and gambling monopolies to Chinese, and head-taxes.

Trade in the early days seems to have been largely by barter, but tin ingots gradually became a recognized medium of exchange and, in Pahang, a curious type of currency was evolved which was derived from the ingot. The coins were of three sizes, large, medium and small, and are sometimes called "hat-money" by collectors. Though of tin they are of little intrinsic value and are true coins. Other states copied the Chinese "cash" in tin, but the inscriptions were in the Arabic character and usually partly Malay, partly Arabic. Small gold coins were also in use.

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1923.

PREFACE.

1. British Malaya includes—

   (*a*) The Crown Colony of the Straits Settlements consisting of the settlements of Singapore, Malacca, the Dindings, Province Wellesley and Penang.

   (*b*) The protected Federated Malay States—Perak, Selangor, Negri Sembilan and Pahang.

   (*c*) The protected Unfederated Malay States—Johore, Kedah, Kelantan and Trengganu.

2. Each of the States has its own Government and its own laws but the latter are as far as possible uniform and are in general conformity with those of the Straits Settlements.

3. The European staff for the whole of Malaya is appointed by the Colonial Office and each member is, as a rule, liable for service in any part of the peninsula or in Singapore or Penang.

HYGIENE AND SANITATION IN BRITISH MALAYA.

Comprising information concerning—

1. The climate and its influence on health
2. The organisation for the promotion of hygiene
3. The European Staffs of the Medical Departments
4. Medical Education
5. Government Medical Institutions
6. The Laws governing prevention and control of disease
7. Registration of Births and Deaths
8. Vaccination
9. Quarantine and Prevention of Disease
10. Zymotic diseases
11. Leprosy
12. Diseases other than zymotic
13. Malaria and malaria prevention
14. Dysentery and Diarrhœa
15. Pulmonary Tuberculosis
16. Ankylostomiasis
17. Urban Sanitation
18. Town Planning
19. Sale of Food and Drugs
20. Coolie Welfare and Estate Sanitation
21. School Hygiene
22. Maternity and Infant Welfare
23. Vital Statistics Federated Malay States.
24. Vital Statistics Straits Settlements

Hygene and Sanitation in British Malaya.

Climate and its Influence on Health.

THE chief characteristic of the Malay climate is its monotony. One day is like another and there is little to mark the seasons. June and December are much the same, a case of continual summer.

Owing to the proximity of large bodies of water the amount of vapour in the atmosphere is high. Clouds are prevalent and dews heavy. Often during the nights a thick white mist forms over the valleys and low lying plains. As the sun rises the mist lessens and at 9 o'clock all is clear. The clear stage lasts for an hour or more and is succeeded by a heat haze which blurs detail. The sky may be clear at 9 a.m. but by noon white clouds have appeared about the mountain tops. The clouds spread and more form peripherally until at 4 p.m. the whole sky may be overcast and showers occur. Such showers are generally heavy and last for 10 minutes to one hour.

The rainfall varies from 80 inches in the plains to 160 or more at the foot of the mountains.

The mean average shade temperature at 9 a.m. is 80°F., at 3 p.m. 84°F. and at 9 p.m. 78°. The mercury never rises to 100 degrees and except in the mountains rarely falls below 70°F.

The amount of water vapour in the air makes it appear hotter in the day and colder in the night than it really is. Dressed suitably and taking it easy in the shade one experiences little discomfort from the heat but exercise in the shade or exposure to the sun quickly causes a flow of perspiration.

The nights are cool enough to necessitate the use of a light blanket.

The rays of the sun are not so powerful as is generally supposed and cases of sun-stroke are rare. Englishmen invariably use sun helmets but Dutchmen wear straw hats and are equally immune to solar symptoms.

To the new comer the climate is often ideal. In continual summer he sees little to grumble at and he puts down the lethargy of the old inhabitant to causes other than climate. A few years residence makes him realize that continual summer is enervating and bad for the nervous system and that to remain in good tone it is necessary for the body to be stimulated by cold. The tissues become lethargic and muscles and brain refuse to act with the vigor natural in a temperate climate. The nervous system becomes run down and jumpy and things beneath notice at home are exaggerated to such an extent as to form serious problems. Tempers are short and brain storms are frequent. Insomnia cases are not rare.

Women, because of their more highly strung nervous systems, do not stand the strain as well as men. For a healthy life it is necessary for men to have home leave at least once in four years and women at least once in three.

White children should not stop out after they are 6 years old, by that time most of them are thin and anaemic.

The various tissues lose to a certain extent their power of resistance and recuperation and diseases are more easily contracted and more slowly recovered from, that would be the case under similar circumstances but in a cooler climate.

It is truly said that Malaya is a good country for those in robust health but a bad country for those run down or diseased.

As in most tropical countries the alimentary system is more sensitive than is the case in cooler climates and indigestion, "liver" and diarrhoea are easily set up by chills or errors in diet.

The climate is favourable for respiratory diseases other than tuberculosis and for rheumatic and gouty affections.

Active tuberculosis cases do badly but cases of arrested disease sometimes do well. On the whole Malaya cannot be recommended for those inclined to tuberculosis.

The Organization for the Promotion of Hygiene.

The organization for the promotion of hygiene in Malaya is partly general, partly local.

The general organization is the Government Medical Service whose officers are available for duty in any part of the country. At present the Medical Service of the Straits is distinct from that of the Federated Malay States and Unfederated Malay States

though officers from one service can be transferred to the other. An amalgamation scheme is under consideration.

The local organizations are the sanitary authorities for the various cities, towns and villages, and the Labour Department for estates and mines.

The health advisers to the cities of Singapore and Penang are the Municipal Health Officers, the advisers to the other towns and villages and to the Labour Department are the Government Health Officers.

Where considered necessary special boards are appointed by Government to deal with special subjects. In the Federated Malay States boards have been formed for malaria prevention, infant welfare and public health education.

The European Staffs of the Medical Departments.

The European staffs of the different Medical Departments are as follows:—

Straits Settlements.

The Principal Civil Medical Officer

The Chief Health Officer and six health officers

3 Chief Medical Officers and 17 medical officers

2 Surgeons

2 Pathologists

The Superintendent of the Mental Hospital.

Federated Malay States.

The Principal Medical Officer

The Director of Government Laboratories and his staff consisting of a bacteriologist, a pathologist, a malaria research officer and three chemists.

The Senior Health Officer and 15 health officers
4 Senior Medical Officers and 46 medical officers
2 Surgeons
The Ophthalmologist
The Radiologist
The Superintendent of the Mental Hospital.

Johore.

The Principal Medical Officer
The Health Officer
2 Medical Officers.

Kedah.

Senior Medical Officer
The Health Officer
The Medical Officer.

Kelantan.

The State Medical Officer.

Trengganu.

The State Medical Officer.

The Municipal Health Department of Singapore includes five Health Officers.

The Municipal Health Department of Penang includes two Health Officers.

Medical Education.

King Edward VII Medical College in Singapore provides means for obtaining a medical qualification locally. The standard of education is high and the diploma granted is registrable in the United Kingdom.

Arrangements have been made in Singapore for the training of Sanitary Inspectors. Training also takes place in the Health Departments attached to the larger centres.

Government Medical Institutions.

The following table shows the number and distribution of the medical institutions.

Straits Settlements.

Hospitals	17
Lunatic Asylums	1
Quarantine Stations	3
Leper Asylums	2
Dispensaries	15

Federated Malay States.

Institute of Medical Research	1
Hospitals	47
Quarantine Stations	1
Leper Asylums	2
Mental Hospitals	1
Town Dispensaries	12
Travelling Dispensaries	17
Decrepit Hospitals	2
Infant Welfare Centre	1

The Laws Governing Prevention and Control of Disease.

The laws which govern the prevention and control of disease are general and local.

Those which apply generally are:—

1. The Registration of Births and Deaths Acts
2. The Vaccination Acts

3. The Quarantine and Prevention of Disease Acts
4. The Sale of Food and Drugs Act (Straits and F.M.S).

Those which apply locally are:—

1. The Municipal Ordinance and Sanitary Board Acts for cities, towns and villages.
2. The Labour Code for estates and mines.

Registration of Births and Deaths.

The registration of Births and Deaths is compulsory throughout the Straits Settlements, Federated Malay States and Unfederated Malay States.

Every Settlement or State is divided into districts each under a Deputy Registrar who is either the Medical Officer in charge of a hospital, an officer in charge of a Police Station or the headman of a sub-district. Deaths must be registered within 12 hours and births within 14 days.

Reports received by the Deputy Registrars are forwarded to the Registrar at definite intervals.

In the Straits Settlements the Principal Civil Medical Officer is the Registrar General, in the Federated Malay States the Senior Health Officer holds that post.

Vaccination.

Vaccination is compulsory for every person below the age of seven years. Most of the immigrant coolies either have been vaccinated before arrival or are done during their period of detention at the quarantine station.

As a consequence of vaccination the majority of the population are wholly or partially immune to small pox.

Quarantine and Prevention of Disease.

The Quarantine and Prevention of Disease Acts make provision for preventing introduction and spread of contagious and infectious diseases.

Though most diseases are contagious or infectious in some way it is usual to confine the Quarantine and Prevention of Disease Act to those diseases which are directly infectious and capable of existing in epidemic form. In Malaya the diseases coming under these acts are Plague, Cholera, Small Pox, Typhus, Scarlet Fever, Diphtheria, Measles, Chickenpox, Enteric, and Cerebro-spinal meningitis.

Provisions are made for—

a. the reporting of cases of disease
b. for the quarantine and disinfection of vessels
c. for the isolation of sick and contacts
d. for regulating movement in infected areas
e. for the control of public places
f. for the disinfection of persons, houses or materials.

The executive officer is the health officer or when there is no health officer the Medical Officer.

Maritime Quarantine Stations.

There are fully equipped maritime quarantine stations in Singapore, Penang and Port Swettenham. The first two have accommodation for 5,000 each, the last for 7,000.

At Singapore and Penang there are launches fitted with apparatus for the Clayton disinfection of ships.

Zymotic or Infectious Diseases.

Plague.

Plague in a mild form is endemic among the rats. From time to time, for reasons unknown, the virulence of the causative organism becomes enhanced and an epizootic spreads among the rodents. When this happens isolated cases of human disease occur, but there is little tendency to spread and up to date there never has been an epidemic. The immunity of humans is ascribed to the consistently high atmospheric temperature which is detrimental to flea propagation. The common Malayan house rat is *Mus grisieventer* and the flea it carries is *Xenopsylla Cheopis.*

Cholera.

Though there have been epidemics of the disease, Malaya cannot be called a cholera country. The reason for the immunity is the rainfall which being normally evenly distributed and adequate in quantity provides tolerable drinking water supplies for the majority.

Occasionally, in certain parts of the alluvial plains during periods of drought, outbreaks occur. Formerly these outbreaks were more common but the provision of public water supplies in towns and villages has had very beneficial results. For some years there have been few cases and no epidemics in the Federated Malay States or the Straits Settlements.

Small pox—Vaccination.

Because of the high percentage of vaccinated individuals in the community small pox is not a common disease.

Occasionally an outbreak occurs in a community which has escaped vaccination and a small epidemic results. Usually such outbreaks are confined to outlying Malay villages where checking of vaccinations is difficult. Energetic action under the Quarantine and Prevention of Disease Enactment eliminates the disease.

Typhus and scarlet fever are unknown in Malaya.

Enteric.

Enteric fever cannot be said to be prevalent. In the Straits the death rate last year was 0.12 per mille, in the Federated Malay States it was 0.02. The reason for the low figures is probably the purity of the water supplies and the comparative absence of flies.

Measles and Chicken Pox.

These diseases are not rare but usually the cases are mild and the mortality rate low.

Cerebro-spinal Meningitis.

From time to time isolated cases occur but never has it reached anything like epidemic form.

Leprosy.

The number of lepers in Malaya is not known but there are 790 isolated in the Straits Settlements and about 550 in the Federated Malay States.

The island of Pulau Jerejak near Penang is a leper settlement which caters for cases from the Straits Settlements and the Malay States.

At the island of Pangkor Laut near the mouth of the Perak River is a small settlement for Malays only. There is an asylum in Kuala Lumpur but the intention is to close this when there is sufficient accommodation at Pulau Jerejak.

In all the above institutions treatment by Chaulmoogra oil or its derivations is carried out. In some cases the results have been very encouraging.

Diseases other than Zymotic.

The principal diseases causing death are malaria, dysentery and diarrhoea, pulmonary tuberculosis.

Malaria and Malaria Prevention.

Malaria easily heads the list as the most important cause of sickness and death. It induces a high death rate and a low birth rate and is one of the chief reasons why such large tracts of fertile land in Malaya remain sparsely populated and undeveloped.

It is impossible to estimate with any degree of exactitude what malaria costs this country annually but taking into account the loss of energy due to sickness, invaliding and death, the check to the natural population increase, and the dampening effect on recruitment of labour the loss in dollars must be millions.

Malaria is preventable, but at a cost, and whether that cost is justified in any case depends on local factors. Malaria prevention is a sound economic proposition where groups of people are gathered together in towns, villages and estates.

The antimalarial activities of the Health Departments include investigation and research, the teaching of mosquitology to dressers, sanitary inspectors and others, propaganda and education of the public, antimosquito measures and quinine distribution.

All health inspectors are trained in both laboratory and field work and are competent to make anopheline surveys. Arrangements have been made for free instruction to estate dressers. Lectures and lantern demonstrations are given in schools and kampongs. Cards and posters have been distributed. Medical men, estate managers and others can obtain free advice and assistance on application to the district Health Officer.

Quinine is distributed free through schools, post offices, district offices and police stations.

In the Federated Malay States there is a board called the Malaria Advisory Board whose duty it is to collect information and advise generally on anti-malaria policy.

In every district there is a local board which deals with local schemes in detail. The Principal Medical Officer is Chairman of the Advisory Board and district Health Officers, the Chairmen of the local boards.

Travelling lecturers visit schools and villages giving popular lectures illustrated by lantern slides.

All three methods of breaking the malaria chain (man to mosquito and mosquito to man) viz., quininization, screening and anopheline eradication, are practised in Malaya.

The method which has met with the greatest success is the elimination of anopheline breeding grounds by land drainage.

Antimalaria drainage, both by open channels and by underground pipes, has in this country reached a high grade of perfection and there are many localities where such drainage has had marked beneficial results. The railway town of Gemas which two years ago was a hot bed of malaria, is now a healthy station and a saving of $50,000 a year has been effected.

Singapore, Kuala Lumpur, Seremban, Taiping, Klang and Port Swettenham are all cases of successful antimalarial drainage. In Kuala Lumpur town there are 130 miles of subsoil drain.

Dysentery and Diarrhoea.

Dysentery and diarrhoea rank next to, but far behind, malaria as a cause of death. As the rates in urban districts supplied with filtered pipe water are higher than the rates for the whole country it is clear that the drinking water supply is not the only factor involved. Probably contamination of food supply is the chief cause. In the towns the majority of people live in cubicles under conditions which necessitate them purchasing food prepared, cooked and ready for eating. Laws and regulations aimed at securing clean food supplies are in force but no law can obviate all the risks involved in the consumption of foods prepared by people who do not understand what are possible sources of contamination and who would not bother if they did.

Compared with many tropical countries Malaya is not fly infected but the house fly is no stranger and, especially in towns, is too much in evidence.

Pulmonary Tuberculosis.

Pulmonary tuberculosis which is a disease more of urban than of rural areas has a general death rate of about 2 per 1,000 per year which is higher than that for the United Kingdom. The death rate for the large towns is about double that for rural areas but this must not be taken as the true rate of the towns for included in the deaths recorded are many who contracted the disease elsewhere and who drifted to the towns for the medical treatment or to enter one of the many benevolent institutions provided for the care of the distressed.

Because of the enervating influence of the climate and the consequent lowering of the bodily tone cases of active tuberculosis have not the chances of recovering they would have in more bracing atmospheres. Asiatics seldom seek advice from a qualified practitioner until they are in an advanced stages of disease when recovery is almost hopeless. Those early cases which do come under notice usually tire of the discipline necessary for their recovery and leave the hospital against the advice of the Medical Officer to return after an interval with symptoms of advanced disease.

Though there are many cases of Europeans with arrested disease enjoying normal lives in the country, Malaya cannot be recommended as a suitable climate for those who have tuberculous histories.

Compulsory notification of tuberculosis was given a trial but was not a success owing to the reluctance of the people to report cases.

The measures directed against the disease are improvement of housing, propaganda and education.

Ankylostomiasis.

Practically all natives harbour the worm but cases showing a noticeable amount of anaemia are, in the absence of malaria, not common.

Why ankylostomiasis is not a greater cause of sickness and deaths in this country has not been worked out. The general disregard of sanitary principles in the practice of defaecation, especially among Tamils who form the bulk of the estate population, would lead one to expect far more trouble from this disease than is actually experienced. The death rate is about 0.5 per thousand per year.

Efforts have been and are being made by the health authorities to prevent the spread of this disease by the proper disposal of night soil but it is difficult to convince either European or Asiatic of the seriousness of ankylostomiasis when so many are infected and so few show symptoms.

Town Planning.

Town Planning Laws have been passed for the Straits Settlements and for the Federated Malay States and special departments have been established to administer them.

Urban Sanitation.

The Municipal Ordinance and the Sanitary Boards Enactments—laws which govern sanitation in cities, towns and villages—have much the same scope as the Public Health Act of England.

They deal with housing, drainage, scavenging, conservancy; water supplies; food supplies including the control of bakeries, dairies, markets and slaughter

houses; the prevention of nuisances including mosquito breeding; the control of malaria; the supervision of hotels, lodging houses, eating houses, theatres and other places of public resort, the levying of assessment.

These laws are very comprehensive and if carried out to their fullest extent ensure a high state of sanitation.

The local sanitary authorities consist of Government officers and non-officials under the chairmanship of a member of the Civil Service. The executive staff include health officers, engineers and sanitary inspectors.

Housing.

The housing clauses in the Municipal Ordinance and in the Sanitary Board acts are thoroughly up to date. No building can be erected until the plan has been scrutinised and passed by the urban authorities. Plans are also required for alterations to buildings. lighting, ventilation, drainage, water supply and latrine accommodation are all governed by by-laws.

Urban Water Supplies.

In the majority of cases towns are supplied with water derived from uninhabited catchment areas and filtered through sand filters. Both slow sand beds and rapid mechanical filters are in use.

Scavenging and Disposal of Refuse.

House to house collections are made in most towns. In the larger towns motor collecting vans are in use, in the smaller ones bullock carts. In Singapore, Penang and Kuala Lumpur disposal is by burning in forced draught destructors, in the other towns disposal is by slow burning incinerators or by dumping.

Disposal of Night Soil.

In Singapore there is a water carriage system, in the other towns the pail system is in vogue and disposal is by trenching.

Sale of Food and Drugs.

A sale of food and drugs act is in force in the Straits Settlements and Federated Malay States. Both are modelled on the English Act.

Under it arrangements have been made for the appointment of analysts and other officers, for the seizure and analysis of samples, for the prescribing of standards, for securing cleanliness and freedom from contamination of any food or drug in the course of its manufacture, for the prevention of fraud.

Standards have been prescribed for milk, butter, brandy, whisky, rum, gin and toddy and for drugs.

Rules have been made for food factories and dairies.

Coolie Welfare and Estate Sanitation.

The Labour Code which is the law relating to labour deals with coolie welfare generally and especially with sanitation and medical attention on estates and mines.

Under it an employer is required to provide for the labourers

(*a*) sufficient and proper house accommodation

(*b*) a sufficient supply of wholesome water

(*c*) sufficient and proper sanitary arrangements

(*d*) hospital accommodation and equipment

(*e*) proper arrangements for the prevention of malaria.

The department charged with authority to ensure the carrying out of the provisions of the law is the

Labour Department to which the members of the Health Department act as health auditors and advisers.

There are 1,945 estates in Malaya situated as follows:—

Straits Settlements	212
Federated Malay States	1,300
Johore	200
Kedah	200
Kelantan	30
Trengganu	3
	1,945

The following figures taken from the last census report shows the number and distribution of the estate population:—

State or Settlement.	Estate Population.	
Singapore	4,077	
Penang, Province Wellesley and the Dindings ..	22,129	
Malacca	18,024	
Straits Settlements ..		44,230
Perak	88,919	
Selangor	98,042	
Negri Sembilan ..	41,144	
Pahang	8,542	
Federated Malay States		236,647
Johore	44,633	
Kedah	38,363	
Kelantan	6,054	
Trengganu	2,014	
		91,064
BRITISH MALAYA ..		371,941

In the Federated Malay States there are 166 estate hospitals, in the Straits Settlements 27. The number in the Unfederated States is not known to the writer.

The estates which have no hospitals of their own send their sick to hospitals on other estates or to Government institutions.

Some estate hospitals are in charge of resident doctors, in the majority the persons in immediate charge are dressers whose activities are supervised by visiting medical practitioners.

All estates are visited periodically by a Health Officer whose duties include the inspection of hospitals, lines, water supplies, latrine accommodation and general sanitation with a view to ensuring that the standards required by the Labour Code are maintained.

The mining population is approximately 82,000. Because of the paucity of Health Officers mines do not receive routine visits.

School Hygiene.

Arrangements have been made for the visitation of schools and the examination of the schoolars. In the city of Singapore a special medical officer has been detailed for the work but elsewhere the duties are performed by the district Health Officers or Medical Officers.

Each school has a stock of Government quinine which is issued free of charge to those requiring the drug.

Travelling dispensaries visit periodically for the purpose of supplying medical treatment.

Maternity and Infant Welfare.

For years there has been a Maternity and Infant Welfare Centre conducted by the Health Department of the Singapore Municipality.

In the Federated Malay States there is an Infant Welfare Advisory Board whose duties are to advise Government. Under this Board an Infant Welfare Centre has been established in Kuala Lumpur. Later it is proposed to form centres in each of the towns of Ipoh, Seremban and Taiping.

Vital Statistics, F.M.S.

POPULATION.

The estimated populations of the Federated Malay States and of the four States at the end of June, 1923, and the census figures for the four large towns are given below.

Federated Malay States.

Europeans and Americans	6,226
Eurasians	3,329
Malays and other races of the archipelago	531,367
Chinese	508,342
Indians	335,089
Others	5,614
Total ..	1,389,667

The four States.

State	Europeans and Americans	Eurasians	Malays and othernatives of the Archipelago	Chinese	Indians	Others	Total
Perak ..	2,193	1,002	248,149	226,247	143,101	1,988	622,680
Selangor ..	2,719	1,673	97,825	175,137	145,703	2,022	425,079
Negri Sembilan	1,004	531	79,426	70,645	37,125	957	189,688
Pahang ..	310	123	105,667	36,313	9,160	647	152,220
Total ..	6,226	3,329	531,067	508,342	335,089	5,614	1,389,667

The census population of the four large towns is given below:—

Town	Europeans and Americans	Eurasians.	Malays and cthernatives of the Archipelago	Chinese	Indians	Others	Total.
Kuala Lumpur ..	1,267	1,286	7,297	48,587	20,889	1,098	80,424
Ipoh ..	427	355	3,583	24,434	7,718	343	36,860
Taiping ..	285	232	1,839	12,193	6,349	213	21,111
Seremban ..	202	288	1,283	12,110	3,058	331	17,272

Deaths.

In 1923, 33.914 deaths were registered giving a death rate of 24.40 per mille population.

The death rates of the several races were as follows:—

Race	Death rate per mille per year.
Europeans and Americans ..	5.46
Eurasians	12.62
Malays and other races of the Archipelago	24.69
Chinese	23.64
Indians	25.77
Others	13.54

Table showing principal causes of deaths in 1923:—

	Death rate per mille population.
Fevers (mostly malaria) ..	11.17
Dysentery and Diarrhœa ..	1.55
Pulmonary Tuberculosis ..	1.39
Pneumonia	1.17
Ankylostomiasis	0.28
Beri Beri	0.27
Syphilis	0.06
Tetanus	0.04
Enteric	0.02
Diphtheria	0.01
Convulsions	2.42
Other diseases	6.03

Table showing death rates in the different States from the principal diseases.

State.	Malaria fevers not diagnosed.	Dysentery and Diarrhoes.	Pulmonary Tuberculosis.
Perak ..	12.46	1.26	1.56
Selangor ..	9.48	1.93	1.48
Negri Sembilan	10.53	1.45	1.41
Pahang ..	11.36	1.73	0.58

Death rates in the four large towns.

Towns being centres where congregate the sick from all quarters it is necessary to make some distinction between those who contract their disease in the town and those who contract it outside. For purposes of death calculations in the Federated Malay States a person who has resided in a town for one month is considered a citizen of that town whether the time was spent in a private house or in hospital. The qualifying period is too short and therefore the deaths rates shown against towns are higher than the true ones. In the Straits the qualifying period is three months.

The following table shows the death rates from the principal diseases in the four large towns in 1923.

Town	Malaria death rate	Dysentery and Diarrhoea death rate	Pulmonary Tuberculosis death rate	General death rate
Kuala Lumpur	2.06	1.77	2.91	19.19
Ipoh ...	1.48	1.34	3.61	20.12
Seremban ..	2.86	3.18	2.45	24.78
Taiping ..	6.94	2.84	3.73	33.45

Infant Mortality Tables.

State.	Death rate of children under 1 year of age per 1,000 births.
Perak	170.21
Selangor	188.44
Negri Sembilan	180.87
Pahang	196.52
Town.	
Kuala Lumpur	186.41
Ipoh	131.64
Seremban	307.02
Taiping	201.36

No. of deaths from Zymotic diseases.

State.	Plague.	Cholera.	Small pox.	Cerebro-spinal meningitis.
Perak	1	—	9	19
Negri Sembilan	—	—	—	4
Selangor	9	—	—	—
Pahang	—	—	—	—

Vital Statistics Straits Settlements.

The following table gives the census populatin for 1921, the estimated population for 1922, the number of deaths and death rates for 1921 and 1922.

Settlement or Province	Population		Deaths		Death rate per mille	
	Census 1921	Estimated 1922	1921	1922	1921	1922
Singapore ..	417,859	435,614	14,111	13,616	33.30	31.26
Penang ..	162,310	164,495	5,126	5,293	31.58	32.11
Province Wellesley ..	130,335	130,478	3,730	4,251	28.61	32.58
Dindings ..	11,927	12,546	366	315	30.69	25.10
Malacca ..	153,159	157,160	4,468	4,128	29.09	26.26
Total ..	875,590	900,293	27,801	27,603	31.75	30.66

The total figures for the city of Singapore are as follows:—

	Population.	Death rate.
Europeans ..	5,192	10.40
Eurasians ..	4,644	22.39
Chinese ..	284,175	32.80
Malays ..	34,890	31.55
Indians ..	28,184	31.08
Others ..	5,512	18.50
	362,597	31.86

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RATTAN.

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RATTAN.

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1923.

Rattan.

I.—GENERAL DESCRIPTION.

RATTAN is the name applied to a number of the climbing palms which are mainly the product of the eastern tropics, and to their strong and flexible stems, which are used for a wide range of domestic and industrial purposes. The rattans which are commercially most important belong to the genera *Calamus* and *Daemonorops*, but others belong to the genera *Korthalsia*, *Ceratolobus*, *Plectocomia*, *Plectocomiopsis*, and *Myrialepis*. The Malay Archipelago produces the largest part of the world's supply, and much of it is exported from Singapore.

Rattans are at first erect plants and remain small for a number of years, when they begin to climb by the aid of long and slender, whip-like flagella, which are armed with recurved thorns that hold on to the surrounding vegetation and so support the plant. Oftentimes rattans trail along on the ground for some distance and then climb, frequently reaching the tops of high trees. The stems are very long, sometimes exceeding two hundred yards, and so being among the longest of known plants. There may be only one stem from a root cluster or there may be several or many, sometimes 100 or more.

There is considerable variation in size and thickness of stem, strength of fibre, size of leaves, and in soil requirements among the different species.

About one hundred species are known from British Malaya, and of these about one half are known to be used commercially. The group is a difficult and incompletely known one, and it is probable that a larger number of the forms may be used. Many of the species are used only locally, if at all. The best forms are collected for export.

II.—METHOD OF WORKING.

1. Collecting in the Forest.

This is done by the local people, usually at considerable distances from the centres of population. The collectors are jungle dwellers, who may be Sakai or other simple and primitive people. The collector selects his plant because of its size, length, strength, and colour, and often collects only a single kind of rattan. He cuts the stem off at the base and then, taking hold of the lower part of it, pulls the plant down from the tree or trees which support it. If the plant has many stems, he cuts only the mature ones. If immature stems are cut the plant may die. The leaves and the soft and useless upper part of the stem are cut away with a stroke of the parang, or jungle knife, and the stem is then cleaned with the parang, or freed of the leaf-sheaths which may adhere to its upper part by pulling it between two branches or about some rough surface. The stem is next cut into lengths of about 16 feet, which are folded once and wrapped in bundles of about 50 to 100 pieces, which are carried to some central place, often a hut near the collector's house, where the rattan is kept until there is an opportunity to turn it over to some buyer. Frequently the jungle people make temporary camps for their rattan collecting in a particular neighbourhood.

2. Middlemen.

When all the rattan has been collected in the chosen area or when a sufficient amount has been obtained to make it worth while, it is carried to some more accessible point, usually on a river, where it is taken over by a buyer. The buyers often go long distances up the streams and are usually Chinese or their representatives. The first buyer may be working independently or he may be working for someone at a small town. The price which he pays is usually very small and he is likely to reject any pieces which are very noticeably inferior. When he arrives at the settlement he often disposes of the rattan to another local buyer who may attend to the shipment to a large port. Rattan frequently changes hands several times before arriving at Singapore, and each of the buyers may do a certain amount of sorting. There is a good deal of loss of weight in drying, and some of the pieces, which were too immature, will shrink a good deal and have to be descarded. There is thus a steady loss in volume and in weight until the rattan is well dried.

3. Handling in Singapore.

When the rattan arrives at Singapore, it may again pass through a number of hands. It is sorted into grades and is given certain special treatment. Kinds which have a natural glaze, which is a more or less waxy surface film, are prepared by being "luntied" (Malay, *runti*). This process consists in rubbing the rattan about a post between two pieces of bamboo, a twisting motion being used. When this process is complete, the rattan is washed in running water, scoured with sharp sand, laid in the sun to dry, bleached in sulphur fumes, and then taken

to the warehouses where it is again sorted. Grading is done on the basis of colour, length and diameter of internodes, and uniformity. The canes are next packed for shipment in the form in which they come to the market. The best grades are sent to Europe and America, and the inferior grades are used locally or sent to China for the manufacture of furniture. Other kinds of rattan may receive a less elaborate treatment, but nearly all kinds are washed and dried in the sun before being shipped. Generally speaking, the canes of small diameter are of more value than the coarser ones.

There are considerable numbers of Chinese in Singapore engaged in the preparation of the canes for shipment. There is a good deal of wasted effort in the numerous handlings which the rattan receives both before and after it reaches Singapore. A better organization of the collecting and handling would result in securing more material and of a more uniform quality. There has been a general tendency toward reduction in quality of the average supplies, during the past fifteen years. This is in part due to exhaustion of the supply of the better sorts in some neighbourhoods and in part to careless methods of collecting and handling.

The names used for the rattan shipped from Singapore are often different from those under which it was collected, and several kinds of rattan are often included under one trade name.

III.—SPECIAL KINDS OF RATTAN.

Many of the rattans of British Malaya are very little known. The following is a brief account, com-

piled mainly from the field notes of forest officers, of some of the more important of the rattans of the Malay Peninsula.

1. Rotan Sega or Rotan Sega Perak.

Calamus caesius Bl.

This, the best of all the rattans, is rather slender and high climbing, flexible, strong, and easy to work. It occurs in quite a variety of soil conditions, sometimes in the clay soil of upland forest and sometimes in the sandy soil of river banks, but it is said not to thrive in fresh water swamp. It occurs naturally in the Malay Peninsula, Sumatra, Borneo, and some of the other islands of the Malay Archipelago. It has been collected for many years, until the natural supply has become small. The wild supply is now supplemented by material from plantations in the Malay Peninsula, Borneo, and Sumatra. The plantations in the Malay Peninsula are small, but are found in most of the States. The planted rattan is said to bear fruit within 5 or 6 years and some of it may be harvested soon after, but it is not commercially mature till 10 or 15 years old. A full grown clump may have from 100 to 150 or more climbing stems, which may attain a length of 100 to 120 feet or more. In one case 156 stems were counted from one clump. This rattan is used locally in the manufacture of mats, chair seats, fancy baskets, and for certain kinds of weaving. It is used in Europe for chair seats, etc.

The stems are unbranched. When very young they are covered by the spiny leaf sheaths, and when mature they have a more or less waxy glaze and are 0.2—0.6 inch in diameter. The length of internodes is 7 to 14 inches and the nodes are very little

different in diameter from the internodes. The surface is glossy yellow, the layer of glazing striped crosswise, the pith grey and splitting easily. The leaves are provided with spiny, whip-like appendages which are the continuation of the midrib. Length, including appendage, 6-8 feet, exclusive of appendage, 1 foot 9 inches to 2 feet 6 inches; leaflets 6 to 8 pairs, 6—9 inches long and 1—1.5 in. wide; pale green above, whitish or glaucous beneath. The under side of the leaflet is a silvery grey, which is the main distinguishing feature between Rotan Sega and Rotan Sega Ayer, the under side of the leaf of the latter being green.

2. Rotan Sega Ayer, Rotan Sembuang, or Rotan Sega Badak.

Calamus palustris Griff. ?

This rattan is usually found growing near rivers or swamps. Not abundant, occurring in well defined areas. Many stems from one clump, slightly less prolific than in the case of Rotan Sega, and said to be of shorter life. Length about 120 feet. Differing in appearance from R. Sega by the colour of the leaflets which are green on their under side. Stem slightly paler in colour, markings much less prominent, and cane coarser and less "solid" in appearance than that of R. Sega, owing to the high water content. Length of joints 8 to 14 inches, diameter up to about 0.8 inch, generally used about 0.4 inch. Seldom used by Sakai or Malays, except as a temporary substitute for other rattans. Occasionally plaited into three strand (whole) ropes for the purpose of securing buffaloes. Does not split into long lengths and does not stand much exposure to the sun. Said to be used in large

quantities in fishing traps on the sea coast owing to its endurance in water. When collected for export, this rattan is always washed in sand. It is generally exported under the name of Rotan Barang, and its principal market is Singapore.

3. Rotan Semambu or Malacca Cane.

Calamus scipionum Lour.

Found from Indo-China, through the Malay Peninsula to Sumatra and Borneo. This is a common, large, climbing rattan which grows on low or high ground and forms a big cluster of as many as 15 young shoots before it starts climbing. The stem is not absolutely round and is 0.6 to 1.2 in. in diameter. The internodes are from 8 to 56 inches long, or even longer, and the nodes are very thick. The surface is smooth, as though polished,—in its natural condition green, yellow, or brown. The heart is dirty grey. It is a strong, inflexible, readily splitting rattan. The sticks are known in trade as Malacca canes and are of several kinds. The three principal kinds are the following:—

Pale or cream coloured sticks are those which have been very carefully dried to preserve an even pale colour. These are the most valuable of all Malacca sticks and particularly fine examples have been sold at as much as £25 or £30 per stick.

Mottled sticks are pale sticks with a fine figure that has been obtained by drying them on coarse gravel. Sometimes, inferior sticks have this figure painted on them artificially.

Smoked sticks are of various shades of pale or dark brown and the colour is the result of smoking and oiling. They are sometimes prepared by boring

a small hole in the top, pouring in coconut oil and then hanging them in the smoke of a wood fire. There is usually a weight attached to the lower end of each stick to keep it straight and smoking may take from two or three days to as many weeks, according to the darkness of colour desired. The smoked sticks are more easily prepared than the lighter coloured ones and less perfect sticks may be used.

Sometimes the pale or cream-coloured sticks are prepared in a rather elaborate fashion. For the first two or three days they are dried in a cool airy place, which is not in full sunlight. After this they are each day, for a period of forty days, polished with a woollen rag on which have been placed the siliceous hairs from the leaf-sheaths of the bamboo. During the whole of this time the sticks must be kept in a cool well-ventilated place away from the direct rays of the sun and protected from moisture. Should they become moist mildew speedily develops and they are spoiled. Other elaborate methods of preparation are also used to prepare fine sticks.

The values attached to the more expensive grades of Malacca sticks are largely artificial. The best grades are supposed to be free from any noticeable flaws, of even colour throughout, of uniform diameter, which should be as nearly as possible $\frac{7}{8}$ of an inch, and with a length of not less than 38 inches between the nodes. Sticks which lack one or more of these characteristics may have a low value, but they are just as useful as sticks, at any rate so far as strength and general usefulness are concerned.

When the sticks are first collected, they are chosen because of length of internode. A good length internode is chosen and a part of an internode on either side of it is taken, so that it may be as well preserved as possible. The stem is cut off about eight inches to one foot below the selected internode and nearly the whole length of the internode above is taken, the total length of the piece cut from the stem being from $5\frac{1}{2}$ to $6\frac{1}{2}$ feet. After drying and seasoning is finished, the superfluous length is removed and the cane is shipped with a length of only about two feet more than the length of the manufactured stick. This is sufficient to allow enough for the bending of the handle.

Stems of Rotan Semambu with internodes too short for the manufacture of Malacca sticks are known as Rotan Chinchang and have relatively low value. They are used for broom handles, cleaners for chimneys and drain pipes, and are sometimes used for furniture, either in a split or an unsplit condition.

Occasionally, other species of rattan may have very long internodes and, when this is the case, they may be used as Malacca canes, but much the largest part of the supply seems to come from the one species.

A brief description of the plant Rotan Semambu is as follows: Several stems grow from one root clump. The stems are unbranched and very long, sometimes over 400 feet. Flagella large and very thorny, 12—14 feet long and growing from the leaf-sheath. "Leaves 8 feet long, sheath green armed scantily with short, flat, dagger-shaped yellow

thorns, solitary and in threes. Petiole 1-3 feet long armed with distant flattened spines 1 inch long, gibbous at base; leaflets broadly lanceolate 1-3 feet long, 2 inches wide, alternate distant."

The plant is widely distributed in the Peninsula, but is not abundant. There is probably more of it in certain parts of Pahang than elsewhere. It is also said to be fairly common in Jelebu District, Negri Sembilan.

4. Rotan Senik.

Korthalsia sp.

A long, very slender rattan, which is widely distributed and fairly abundant in the foothills. Many stems (60 to 100) are borne in one clump and they reach a length of more than 200 feet. The stem is very pale yellow in colour and of very good quality. It is the thinnest of the rattans, 0.2 to 0.3 inch in diameter and rather regular; internodes 4 to 14 inches long; nodes not much enlarged. Leaf-sheaths brownish, with a pair of enlarged ocrea, which are used as ant nests; spines inconspicuous. Leaves, to base of cirrhus, 2 feet 4 inches to 3 feet. Cirrhus 2 to 4 feet long. Leaflets 7 to 10 pairs, 9 to 11 inches long and 1¼ to 2 inches wide. This form is extensively used locally and is said to be quite strong. It is plaited into ropes (3 strand) for tying buffaloes, for stands for cooking utensils, unsplit for chiks, matting, fishtraps and baskets. Not used split. Collected for export and mixed in the market with various other kinds. It is washed in sand before export, and is sometimes mixed with Rotan Busok, which is the next thinnest rattan and has a bad odour.

5. Rotan Tanah.

Abundant and widely distributed, occurring under a wide range of conditions. The name Rotan Tanah is given because this rattan frequently creeps along on the ground for some distance before climbing. As many as 30 stems are borne from one clump and they reach a length of 150 feet. Cane a pale yellow. Length of internode up to 25 inches; diameter up to 0.6 inch. A very durable cane. Seldom used whole except plaited into a three strand buffalo rope. Used split for a variety of purposes, but does not split finely. Used for tying thatch, basket making, etc. When collected for export it is washed in sand and mixed with other rattans under the name of Rotan Barang.

6. Rotan Batu.

Calamus insignis Griff. ?

A fairly abundant and well distributed rattan on hill slopes and on the well drained banks of rivers. Stems 20 to 30 per plant, up to about 200 feet in length. Cane plain pale yellow. Said to be very strong and probably our most durable rattan. Length of joint 7 to 13 inches; diameter about 0.3 inch. The cane is used whole, split, and "drawn," and is considered superior to Rotan Sega in every way except in the matter of natural polish. Used whole for buffalo ropes, securing beams, etc. When "drawn" it is used for furniture and basket making. Split, it is used for tying thatch, fishing traps, bird snares, furniture and mats. This rattan is in great demand. It is sold unmixed, after being washed in sand. It is probable that other species with similar stems are also known by this name.

7. Rotan Tunggal.

Calamus pencillatus Roxb. var. ?

This is a rattan of medium size which is widely distributed in the Peninsula on low hills and well drained areas. The name Tunggal refers to the solitary habit of this species, only one stem being borne from each plant. The stem is of medium size, sometimes 400 feet or more in length, and conspicuous because of the freedom from thorns of the leaf-sheaths and the small size of the leaves. The cane when exposed by the removal of the outer skin shows fine but prominent parallel corrugations running the whole length of the stem. It is of a light yellow colour and is hardly distinguishable from Rotans Bujang and Kembong, which are said to possess the same qualities, but with a slightly paler colour. Length of joint 6 to 26 inches; diameter 0.2 to 0.4 inch; nodes projecting slightly and with a black line. Leaves rather pale green, 10 to 15 inches to the beginning of the spiny portion, which is very slender and 1½ to 3½ feet long. Leaf-sheath green with light-coloured swellings arranged more or less in rows. Leaflets about 13 pairs, about 6 inches long by ¾ inch wide.

Possibly the most useful rattan in the forest to the Malay and Sakai and preferred by the Malays to almost any other. It is seldom used whole except in the manufacture of deer snares or for tying buffaloes, a single stem being sufficient. It splits finely into long lengths and can be "drawn" to the most minute diameters. It is strong, bends without

destruction to the fibres, and will do almost anything asked of it. There is practically no limit to its uses. It is washed in sand, mixed with other canes, and sold under the name of Rotan Barang, scarcity being given as the reason for not putting it in a class of its own with Rotans Bujang and Kembong.

8. Rotan Kertas.

Calamus sp.

This medium-sized rattan is not plentiful but widely distributed and prefers the foothills. A single plant has as many as 30 stems, some of which reach a length of about 250 feet. The name Kertas refers to the papery nature of the leaves, and the stem also has a papery fibrous covering. This covering material is removed by the collector, leaving a pale yellow, smooth, waxy surface. It is customary to lunti this form. Internodes 8 to 28 inches in length and up to $\frac{5}{8}$ inch in diameter; nodes not much thicker than the internodes and the quality is quite uniform. Flagellum from the leaf-sheath, $3\frac{1}{2}$ to $6\frac{1}{2}$ feet long. Leaf-sheath greenish grey, without spines, or with small spines. Leaf 1 foot 9 inches to 2 feet 6 inches long; leaflets 7 to 9 pairs, 7 to 9 inches long and 1 to $3\frac{3}{4}$ inches wide. Cane of good quality, strong but not hard. Used whole, split, and occasionally "drawn." Whole, a single strand is used as a buffalo tie, also for securing beams and general building purposes. Splits well with care and into fairly long lengths, and is used for tying purposes, baskets, fishing traps, furniture making, etc. An excellent cane which should do well in a class by itself. Washed in sand, and marketed under the name of "Rotan Barang."

9. Rotan Lilin.

Calamus pencillatus Roxb. ?

A rather plentiful slender rattan which is widely distributed in hilly country. The name Lilin refers to the waxy feel of the stem. Six to thirty stems are borne by one plant and they reach a length of 100 to 170 feet. The outer skin of Rotan Lilin is smooth, while that of Rotan Senik is thorny. Internodes 3 to 13 inches long, 0.2 to 0.4 inch in diameter; nodes prominent and with a dark colour. Flagellum borne from leaf-sheath, 3½ to 12 feet long. Leaf-sheath usually yellowish, very spiny. Leaves 1 to 5 feet long. Leaflets 16 to 25 pairs and arranged in groups; 7 to 16 inches long and ½ to 1½ inches wide. Used for furniture and weaving but not very much in demand. Washed in sand and sold mixed as Rotan Barang.

10. Rotan Pasir, Rotan Sega Padang.

Found only on flat land. The stem has a waxy surface. The natural glaze is less pronounced than in Rotan Sega and the diameter of the stem is slightly less. Not abundant. Each plant has 10 to 20 stems, which attain a length of from 60 to 120 feet. Inferior to Rotan Sega in that it shrinks badly in seasoning. Often mixed with Sega for marketing. Used for furniture.

11. Rotan Udang.

A fairly large rattan, which is abundant and widely distributed, but seems to thrive best on well watered flats. Stems as many as 60 or 70 from one clump and reaching a length of 200 to 250 feet. The name Udang is used because the leaf-sheath resembles a prawn in shape. Cane coarse and of a reddish

colour. Length of joint uniform and about 9 inches; diameter about 0.6 inch. A very durable cane, which is never used whole. Splits finely and into long lengths. Used for tying thatch, carrying baskets, mats, sieves, strainers, baskets, and ropes for boats. A most useful rattan to both Sakai and Malay. A decoction of the fruit is used in cases of dysentery.

12. Rotan Kerai.

Calamus sp.

A widely distributed but not abundant coarse rattan, which thrives best on well drained flats. Stems 5 to 15 from one clump and reaching a length of 150 feet. Cane straw yellow, ribbed, 0.4 to 1 inch in diameter; internodes 4 to 14 inches long, nodes conspicuous and rather projecting. Flagellum borne from the leaf-sheath and about 5½ feet long. Leaf-sheath very spiny. Leaf 5 feet or more long. Leaflets about 95, about 8 inches long and 0.6 inch wide. Very durable if not in contact with water; used both whole and split for framework of baskets, etc.; very firm when dry and will not lose its shape. The stem is washed in sand and sold, mixed with other kinds, under the trade name of Rotan Barang.

13. Rotan Cheriau.

Daemonorops sp.

A rather coarse rattan, which is abundant and widely distributed in swamps. Stems as many as 70 from a single clump and with a length of 150 to 200 feet. Cane dull yellow, ribbed, 0.5 to 1 inch in

diameter; internodes 6 to 20 inches long, regular; nodes conspicuous. Leaf 5 to 7 feet long to end of leafy portion; cirrhus 3 or 4 feet long. Leaf-sheath brown with hairy spines, arranged spirally or on ridges. Leaflets about 60 to 65 pairs, 13 to 15 inches long and 0.6 to 0.7 inch wide. One of the commoner forms, which is very durable, and is always used split. It is washed in sand before being used. Splits finely and into long lengths and is used for the manufacture of mats, baskets, and ropes, and for tying fences and house timbers. A very valuable rattan for tying purposes.

14. Rotan Dahan.

Plectocomia Griffithii Becc. and *Korthalsia* sp.

The name Dahan refers to the branching habit of the stem and may be applied to any rattan which has this habit. The first mentioned species is described by Ridley as follows: "One of the coarsest rattans, which frequently breaks small trees by its weight. The stem is not evenly thick. It starts out with a relatively small diameter and increases in size upwards till it is 3 or 4 inches in thickness. The nodes are very prominent and the stem is branched. The quality of the rattan is poor and it is used for comparatively few things, such as the legs of steamer chairs, mining baskets, and coarse cables. The stem contains a good deal of drinking water and dies after flowering. Common in the lowland forest and of little value."

The second form is abundant and found under a variety of conditions, but seems to prefer low lying well watered areas. Several stems from one clump, reaching a length of about 150 feet. Cane reddish

brown in colour, with a fibrous covering; diameter up to about $1\frac{3}{4}$ inches; internodes 7 to 13 inches long; nodes rather conspicuous. Leaf-sheath pale and spiny, with two large ocrea at the node. Cirrhus 2 or 3 feet long. Leaflets 5 to 7 pairs, 7 to 9 inches long and 3 to 4 inches wide. Used both whole and split, whole for furniture and other frames; split for the same purposes and fish traps; distinctly reddish brown inside.

It is said that Rotan Dahan in Pahang is usually found in three distinct diameter classes. The largest is called "Pipi Kelah", medium "Rotan Dahan", and small "Rotan Dahan Tikus".

15. Rotan Kikir.

Calamus sp.

A rather slender rattan, which is fairly abundant and widely distributed, thriving best in well watered areas. The name has reference to the leaf-sheath, which is like a file. Stems as many as 30 from a single clump and reaching a length of as much as 250 feet. Cane pale yellow, soft, 0.2 to 0.6 inch in diameter; internodes 6 to 30 inches long, irregular; nodes inconspicuous. Flagellum from the leaf-sheath, $2\frac{1}{2}$ to 4 feet long. Leaf-sheath green with short spines arranged in circles; used as a file or grater by the Malays. Leaf $2\frac{3}{4}$ to 3 feet long. Leaflets 10 pairs, 12 to 15 inches long, 0.9 to 1.1 inches wide. The whole cane is used for fishing trap frames, tying, etc. It splits finely and into long lengths and the split cane is used for basket making and tying. When "drawn" it is used for mats. Long internodes are used for walking sticks.

16. Rotan Manau.

Calamus ornatus Bl. ?

A very large and long rattan which is abundant on the lower hill slopes. One stem to a plant, attaining a length of more than 500 feet. One which was displayed at the Malaya-Borneo Exhibition in 1922 was 556 feet long, and it is said that occasional plants more than 660 feet in length are found. Canes very blotchy, varying from pale green to a washy yellow, distinctly mottled when dry; diameter up to about 2½ inches; internodes 6 to 14 inches; nodes almost flush with the stem. Used both whole and split for furniture, basket frames, bridge cables, and sometimes for cricket bats.

17. Rotan Sabut.

Daemonorops hystrix Mart. ?

The name Sabut refers to the fibrous cover of the leaf-sheath and the fibrous composition of the inner portion of the cane, suggesting the fibre of the husk of the coconut.

An abundant rather thick rattan, which is found in valleys and on the lower slopes of hills. Stems as many as 30 from one plant and reaching a length of as much as 150 feet. Cane yellow, 0.5 to 0.8 inch in diameter; internodes 4 to 14 inches long, regular; nodes conspicuous. Leaf, to base of cirrhus, about 8 feet. Cirrhus 2 to 3 feet long. Leaf-sheaths very spiny, brownish in colour. Leaflets 30 to 40 pairs, 1½ feet long and about 1 inch wide. The leaves have a distinctly glaucous appearance, and the scales have dark brown tips. Inside of cane

light brown, not durable; split into long lengths, used for tying purposes and for rough basket work. A certain amount is collected, washed in sand, and sold under its own name.

18. Rotan Ayer, Rotan Tawa, Rotan Getah.

Daemonorops sp.

A very coarse rattan which is abundant on the banks of rivers and swamps. As many as 70 stems are borne by a single plant and these may reach a length of as much as 100 or 150 feet. The name Ayer signifies that the plant is always found near water, Tawa that the water is tasteless, and Getah that the stem is sticky when cut. Cane slightly angular and washy yellow in colour, 0.6 to 1½ inches in diameter; internodes 13 to 25 inches long, regular; nodes conspicuous and dark. The stem dies down when it reaches its full length. Leaf 8 feet to end of rachis and with a cirrhus 4 feet long. Leaf-sheath greyish green with rather long spines arranged in spiral rows; leaflets about 100 pairs, spiny, 11 inches long and ¾ inch wide. The cane is not durable. It loses about 2/3 of its weight in drying. Used split for tying purposes and rough basket work. An exudation from the cane is used as a specific in skin diseases. The canes are washed in sand and exported under the trade name of Rotan Ayer.

19. Rotan Ungas.

An erect rattan which is fairly plentiful on high hills. Very easily distinguished by its layering capacities and very short internodes, which are usually not more than 2 inches long. Diameter up to 1 inch. The stem is single but, on reaching a

height of about 6 feet, it droops to the ground, takes root near the tip and sends up a new upright shoot, which behaves in the same way. It is not uncommon to see 6 or 8 such stems being formed. The stem is green when first cut but, after preparation, a very pale yellow or a deep brown. Of no use except for walking sticks of which it provides some very handsome specimens.

20. Rotan Jerenang.

Daemonorops spp.

This is the name applied to several species the scales of whose fruits are more or less covered with a kind of reddish resin, which is collected and sold as the "Dragons' blood" of commerce. The stems are not known to be used and are probably of poor quality. The resin is collected in various ways. It is sometimes prepared by drying the fruits and then shaking them in a small basket with cockle shells. The resin thus beaten off falls through the meshes of the basket and is collected on a cloth damped in hot water, and squeezed into a block. Sometimes the dry flakes of resin are collected and sometimes the block is broken up to make a powder. It is said that the purest dragons' blood is obtained by shaking the dry fruit and melting the obtained resin. In some places in the Dutch Indies, the ripe fruit is put in a basin with water and crushed. The resin is separated out by the water, which is strained to remove the fruit remains which have lost their colour. This water is left standing and the resin settles at the bottom of the basin; the water is removed and the remaining pigment poured into baskets made of pandan leaves, in which it

hardens after about 10 days. Practically all of the supply of dragons' blood is sent to Singapore, from which place it is exported. It has a value of from \$20 to \$40 per pikul and the total amount exported is not great, amounting to only a few pikuls per year. It has now disappeared from all pharmacopeias and is used principally for Chinese medicine. Small quantities are used in factories of spirit-lacquer, but it seems to fade in the light. Painters sometimes prepare it with gum water to make a purple paint like Florentine lacquer, but it cannot be mixed with oil. It is sometimes used to produce a red colour in woven rattan. Dragons' blood gives a pleasant odour when thrown on coals and is therefore sometimes used as an ingredient of incense. It will probably always be found in sufficient quantity to supply the limited demand which exists for it.

The species, occurring in the Malay Peninsula, which are credited with producing dragons' blood are the following:—

Daemonorops propinquus Becc., known as Rotan Jerenang,

D. micracanthus Becc., known as Rotan Jerenang, and

D. didymophyllus Becc., known as Rotan Getah, Rotan Hudang, and Rotan Butong.

IV.—TRADE IN RATTAN.

Rattan is the most important of the minor products of the forest in British Malaya. It has a very large local and domestic use, the value of which is very hard to estimate. The material collected for

export in British Malaya and from many places in the Netherlands Indies and the Philippine Islands comes to Singapore. The average volume of trade in rattans at Singapore for the years 1900—1920 was:—

Imports 457,713 pikuls*, with a value of $3,728,773.

Exports 436,193 pikuls, with a value of $4,709,619.

This shows a loss of volume of 21,520 pikuls per year and a nett gain in value of nearly $1,000,000 per year by the treatment which rattans receive in Singapore, or an increase in average price from $8.14 per pikul to $10.80 per pikul.

The trade is largely in the hands of Chinese, who do nearly all of the work of preparing the rattan for export.

* 133⅓ lbs.

MALAYAN SERIES No. XVIII.

GUTTA PERCHA.

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Gutta Percha.

I.—INTRODUCTION.

1. Definition and Nature of Product.

GUTTA PERCHA is a gum which has the remarkable property of being the best non-conductor known for both heat and electricity. It looks like rubber when it comes as a whitish latex from the tree, but it differs from rubber in that it is much less elastic and becomes plastic when heated to about 150° F. (60° C.) and will retain, on cooling, any shape given it while hot. It retains its composition practically unchanged almost indefinitely when submerged in water, and its greatest single use is in the coating of submarine cables. It is also used in electrical equipment, for the making of moulds or casts, in surgical and dental work, and for funnels and bottles to be used with certain chemicals.

2. Botanical Source.

All of the more than one hundred species of the family *Sapotaceae* in British Malaya produce gutta percha, but, in most cases, it is so mixed with various resinous substances as to make it of too little value to be worth collecting. A few species, principally in the genera *Palaquium* and *Payena*, have gutta present in sufficient amount to make them of commercial importance. The best grade of gutta percha is produced by *Palaquium Gutta* Burck, which is known in the Malay Peninsula and in parts of Borneo as getah taban merah, and in Sumatra as njatoh balam merah or njatoh duryan.

It is known as temiyang in parts of Borneo. The species is native to the Malay Peninsula, Sumatra, Borneo, and a few of the adjacent islands. Certain varieties have been described, and one of these has been considered a distinct species—*P. oblongifolium* Burck; but the examination of large amounts of material makes it appear that getah taban merah is really but one species which has a fair amount of natural variation. Other species which produce gutta percha of a less valuable sort will be mentioned under inferior guttas.

The term getah is a Malay word for a sticky gum, and pertja is said to be the Malay name for one of the less valuable guttas and also for the Island of Sumatra. The term gutta percha therefore may be a corruption of the original native names, or may merely mean Sumatra gutta.

3. Method of Production of Gutta in the Tree.

All of the different forms produce their gutta in the same way. There are no long laticiferous tubes in the bark, but, instead, a large number of irregular cavities, sacs, or intercellular spaces, which are not connected up for long distances through the bark, as is the case with laticiferous tubes. Consequently, tapping cannot be done, as in Para rubber, by one or a few cuts. Cavities containing gutta are also found in the leaves and pith, but not in the wood.

4. Description of Getah Taban Merah.

Palaquium Gutta Burck.

Medium-sized trees of the second storey in the forest. Trees more than one hundred feet in height and ten feet in girth are said to be sometimes found, but are certainly very rare. Trees much more than

five or six feet in girth are seldom found. When grown in the open the tree branches low. The leaves are simple, alternate, and crowded together towards the end of the twigs, dark shiny green above, and silky brown pubescent beneath, 4 to 6 inches long and $1\frac{3}{4}$ to $2\frac{1}{2}$ inches wide, but larger on young trees. The veins are about 20 to 30 on each side of the mid-rib and are not very distinct. Flowers axillary in groups of four, white. Fruit a fleshy egg-shaped berry, brownish pubescent on the surface, about $1\frac{1}{2}$ inches long and 1 to $1\frac{1}{4}$ inches in diameter.

5. Geographic Distribution.

It was at one time stated (Obach-Cantor Lectures—1897) that gutta percha was only produced in a rectangular area extending about 6° north and south of the equator and from 99° to 119° east longitude. This area does contain most of the gutta and practically all of the best grade, but it is now known that gutta percha trees of certain kinds occur as far north as Indo-China and the Philippine Islands, throughout the Malay Archipelago, and as far to the south-east as New Guinea.

II.—ABUNDANCE AND NATURAL DISTRIBUTION.

1. Manner of Occurrence.

Getah taban merah does not naturally form pure forests, but is accompanied by a large number of other kinds of trees, many of them of larger size. It may often be present to the extent of a large number of individuals per acre, but it is rarely, if ever, the most abundant tree under natural conditions. There are often fair numbers of young

plants, but these are less aggressive than those of some other species and are very likely to be hindered or delayed in development by other trees. It is often the case that a few scattered trees of this kind are to be found in a large forest. It seems that individuals are able to persist in places where the conditions are not favourable for quantity development.

2. Area Occupied.

There is known to be, in the Federated Malay States, an area of as much as 300,000 acres which can be considered as getah taban merah forest. There are also considerable areas of such forest in the Unfederated Malay States, Sumatra, and Borneo. There are also still further areas in which occasional trees are found. The estimate of 300,000 acres in the Federated Malay States refers to forests within which it would be possible for gutta percha to be made the principal crop, although it is not so at present. Most of the area in the island of Singapore which originally bore gutta percha trees has been cleared, but there are still remaining on the island, on Pulau Jerajak near Penang, and in the settlement of Malacca a few spots where the tree is found.

III.—EXPERIMENTAL STUDIES.

The Forest Department of the Federated Malay States has for a number of years carried on experimental work with gutta percha trees. The Netherlands East Indies Government has carried on a larger amount of work in Java and Sumatra, and for a longer time. The following notes are gleaned from different government reports and have reference to getah taban merah (*Palaquium Gutta* Burck), unless otherwise stated.

1. Improvement Fellings.

It has been successfully demonstrated, in the Federated Malay States, that the gutta percha tree needs a considerable amount of light for its best development and that many individual trees do not flourish or are of slow growth simply because they are not so located as to get a sufficient amount of light, both from overhead and from the side. Trees that have been overcrowded or shaded and have been freed by the cutting away of the overshadowing vegetation invariably show very much increased vigour. It has been found that a forest which contains a fair amount of natural regeneration of this tree can be gradually changed over to an almost pure gutta percha forest by a gradual removal of other species. Since 1902 some 15,000 acres of forests have been improved in this way. In a few cases it has been possible to combine the working of timber and firewood from other trees with the operation to improve the gutta percha.

2. Rate of Growth.

Gutta percha which is favourably situated grows very rapidly. Measurements that have been made of 282 trees in forest sample plots during a period of five years have shown an average girth increment of 1.57 inches per year and have indicated the following relationships between girth and age:—

Girth—inches.			Age—years.
12	..	..	8.2
24	..	..	15.7
36	..	..	20.6
48	..	..	28.3
60	..	..	37.9

The old opinion that the tree is of very slow growth is evidently erroneous, although trees which have insufficient light, because of shade from larger trees, probably do grow very slowly. It is probable that carefully regulated conditions in the forest or in a plantation may secure a rate of growth even more rapid than that indicated.

3. Natural Regeneration.

In places there is very good natural regeneration, but seedlings are often choked out or very much retarded in growth by other trees and brush. Fruit is borne very abundantly some years, but little of it survives. A tree of medium size may bear from 5,000 to 10,000 seeds. It is said that, in many cases, the flowers do not reach maturity because they are attacked by insects or because weather conditions are unfavourable. A heavy rain at the time that the flowers are open may do so much damage that no fruit will be set. There seem to be a number of chances which may prevent the development of fruit. In spite of unfavourable conditions, it is doubtful if there is any year when there is no seed, although the time for the crop is not certain. Ripe fruit have been collected in the months of January, February, March, May, June, October, and November, and fully opened flowers in the months of March, June, July, August, September, October, and November. It is doubtful if it can be fairly said that there is a definite and regular periodicity of flowering and fruiting seasons. This condition is not uncommon among our forest trees and probably indicates that the occurrence of flowering and fruiting times is closely tied up with the distribution of the rainfall. This is further

indicated by the local occurrence of flowering and fruiting. It may happen that trees in one locality will bear flowers and fruit, while trees in another locality, but a few miles distant, will show no signs of fruit. There are, however, certain years when there is a rather general and heavy seed crop. (1921 was such a year). Our records are not complete enough to show whether this is a phenomenon of regular occurrence. After the fruit is formed there are still a great many dangers to be faced before fertile seed is produced. The fruit has a number of insect enemies. The ripe fruit is greedily eaten by fruit bats, which, however, do not seem to eat the seeds, and there are often large numbers of ripe seeds to be found on the ground underneath a bat roost. When the fruit drops it is quickly attacked by squirrels, birds, insects, and other animals, and a very small proportion of the seed has a chance to germinate. Carefully selected seed will show a germination of from 75 to 85 per cent. or more, but does not retain its vitality for a very long period. Some seeds will germinate after they have been kept for as much as two months, but the percentage of germination is very much reduced.

4. Artificial Regeneration.

Gutta percha can be grown from cuttings and from marcots, but the percentage of success is not high and these processes have not shown much promise of being economically successful. It is also possible to propagate the tree by layering and by divisions at the root collar, with roots attached, but these methods are also less successful than the planting of seeds. Planting of gutta percha has been done in a few places and it may some day

become a successful plantation crop for private enterprise. The Dutch, in Java, were the first to do any considerable work of this kind.

In the Netherlands Indies.

There seemed a good deal of danger lest the naturally grown supplies of gutta percha should become exhausted, and, rather more than forty years ago, a systematic investigation of the trees producing gutta percha and the methods of propagating them was made by Dr. W. Burck, then Assistant Director of the Botanic Gardens at Buitenzorg. Dr. Burck published, in 1887, an account of the plants producing gutta percha and experiments with planting were started at Tjekeumeh, near Buitenzorg. Later, a plantation of the better kinds of gutta percha trees was started, on a commercial scale, at Tjipetir, and this plantation has been very successful. It is understood that a certain amount of planting has been done at other places, and it is possible that the different gutta percha plantations in the Netherlands Indies may have a total area of as much as 10,000 acres. They are maintained for the production of leaf gutta and to secure a supply of seed for future planting. The present policy is to keep the plants low so that the leaves can be readily plucked.

In the Malay Peninsula.

Some fifteen years ago the Forest Department in the Federated Malay States began the planting of gutta percha in some of the forest reserve. Small areas had been planted in the Straits Settlements and in Selangor some years before. The Departmental planting has been aimed mainly at filling up

blanks in rather poorly stocked taban areas and has seldom been done on plantation lines. The total area planted will amount to about 2,000 acres.

In 1915, one company, affiliated with one of the cable companies, secured land in the Kuala Lipis district of Pahang and began a plantation of gutta percha. The plantation has an area of 6,000 acres, of which about 1,000 acres have been planted up. The work has proved to be unexpectedly expensive, largely because of the great difficulty experienced in getting a supply of seed for planting. The plants for plucking are being grown in bush form.

The total area of planted gutta percha in the Malay Peninsula is probably not more than 3,000 acres.

It has not yet been demonstrated that gutta percha is a profitable plantation crop in the Malay Peninsula, although there is some prospect that it may become so. It would certainly be most unwise to embark on such planting now unless the planter were prepared to face very long delays and many failures. The greatest single difficulty at present is the lack of a sufficient supply of seed, and there is every prospect that this will continue to be a difficulty for a number of years to come.

IV.—HARVESTING.

1. The Original Method.

The method originally used by the native was to fell the tree, lop off the branches, and collect the gutta by making a number of wide cuts through the bark at intervals of a foot or more. Some of the gutta was wasted by falling on the ground; some was collected from the cuts or from receptacles

placed under them; and a great deal could not be extracted and was left in the bark. The process was most wasteful and greatly reduced the supply of gutta percha trees. The only good thing to be said for this method was that small trees, under six inches in diameter, were left, because it was not considered profitable to collect from them. The use of this method of collecting has, for many years, been forbidden in the Federated Malay States, except on land which was shortly to be alienated. It has, however, been practised in many of the other parts of the range of the species and the native collector is very much inclined to collect in this way, unless he is closely supervised. The gutta secured by the old method is often adulterated with the sap from other plants, or has sticks, stones, or bark placed in it to increase its bulk. This prevalent practice has made it necessary to inspect rigidly all gutta products brought into Singapore, and an extensive business in the purification and preparation of gutta for export has developed there.

2. Tapping.

Various methods of tapping have been tried. The one which has been most fully described is the following:—"A ladder consisting of a single pole with cross pieces, is lashed to the trunk of the tree. Cuts are made into the bark at an angle of 45° to the axis of the tree over the whole stem and on the main branches. Any number of these cuts may be joined by a vertical cut: this is a matter of convenience on each individual tree. Hitherto cuts have been made at intervals of from 8 to 12 inches on two sides of the tree, the cuts being so arranged as to leave a strip of untapped bark on either side

of the tree, each strip being about four inches in width. The cut should reach the inner layer of the bark, but should not penetrate the wood. The regulation of the depth of the cut is difficult owing to variations in the thickness of the bark and the the impossibility of complete supervision. As the tapping is not confined to that part of the tree which is near the ground, ladders are necessary, and the tapper is usually working in an uncomforable and strained position, so that some latitude must be allowed both in the placing of the cuts, and in the depth to which they penetrate. The greater portion of the latex coagulates in the cuts, but some of it may run down the lateral into the vertical cuts where it is collected by means of a small tin cup stuck into the bark. The cups are put into the bark at intervals as may be found necessary. In the case of *P. oblongifolium* cups of two inches in diameter and one and a half inches deep are large enough. *P. obovatum* flows more freely and in greater quantities, and therefore requires larger cups. When collecting the gutta from the cuts, the tapper scrapes out a small quantity with his knife and works it into a ball: this ball is then pressed into the cut and rolled along it, collecting gutta as it goes after the manner of a snowball. Having been rolled along several cuts, the ball assumes the shape of a flat disc, the gutta being always collected on the edge. The same disc may be used until it gets too wide at the edge to fit into the cuts, when a new one is started. Gutta is collected several times at one tapping from the same cut. Each time the ball or disc is rolled along the cut, the removal of the gutta re-opens the cut ends of the latex tubes,

and the flow commences again. The process is continued until the flow ceases. The tapper carries a basket as he climbs, in which he keeps his tin cups and the collected gutta.

........it is very noticeable that considerably more gutta is obtained from the upper portion of the stem and from the branches than from the lower part of the stem..............

In wet weather the latex flows much more freely than in times of drought,......Early or late tapping has the same effect. The greater quantity of water present in the tree in the early morning keeps the gutta in a liquid state. As evaporation proceeds during the day the gutta thickens and eventually ceases to flow. It is, as might be expected, also noticeable that the flow is maintained till a later hour on dull and sunless days. From the foregoing it will be obvious that, to be successful, it is necessary that tapping should begin directly it is light enough for the tappers to work........The tapping is usually finished by 11 a.m., and the gutta is then taken to the store and roughly cleaned, each tapper being responsible for his own collection. Before returning to the store the trees to be tapped the next day are selected and the ladders fixed to them, so that the early hours of the day may not be wasted. The cleaning process is effected by immersing the gutta in hot water, when it quickly becomes plastic, in which state it can be worked with the hands and the greater part of the bark and dirt removed. While soft it may be pressed into any convenient shape for storing. The cleaning process gives the gutta a very much better appearance, and it is also of advantage in that it puts it into a form in which less of its surface is exposed

to the air. In the rough state, that is in discs and scraps as picked from the cuts, it is liable to deteriorate by oxidation. The cleaned gutta is kept in the best condition if stored submerged in water." Barnard, B.H.F.—Notes on Gutta Percha.—Kuala Lumpur, 1916.

The use of a ladder is now obviated by the introduction of a simple climbing stick, which grips the tree and on which the tapper can comfortably stand.

Many thousands of trees have been tapped and they have been found to yield from a few ounces to three or more pounds of cleaned gutta per tapping, according to the size of the tree. It has been found that the same tree can be tapped several times, if a sufficient time (probably not less than two years) is given for recovery after each tapping, but there is always danger that decay may get started or that white ants may attack the tree through the wounded surface. The difficulty attendant upon this work makes it desirable that some less arduous and more attractive method of collecting should be devised, although the product obtained is the finest grade of gutta percha known.

3. Leaf Collecting.

Gutta percha of excellent quality occurs in the leaves of getah taban merah, and this can be extracted by grinding the leaves and treating them with hot water. Some years since a factory was started at Tjipetir, in Java, to do this, and later another factory was started at Singapore and still another on one of the islands near Singapore. The first factory used leaves from trees grown in plantations; the other two bought leaves that were

collected in the forest. The first impression of this method of work was that it was a great improvement on old methods, but it soon developed that the native collectors were cutting down small trees to make the leaf collecting easier, and the method is no longer used. Within the past five years three factories for the extraction of leaf gutta have been started in the Malay Peninsula. The first of these factories was located at Kuantan, Pahang. The process of leaf collecting for this factory is as follows:—The trees selected are pruned into a rather conical shape, so that as large as possible a surface may be exposed for leaf production. The amount of leaves collected is large, and collecting is repeated at intervals of one year. The two other factories are in the Kuala Lipis district of Pahang. One factory uses leaves collected by Malays or Sakai from forest grown trees, and the other is on the large gutta percha plantation and is intended to use the leaves from planted trees. The original factory at Tjipetir works approximately as follows:—The material used consists of leaves, twigs, and bark. At intervals the trees are pruned to keep them in a convenient shape and size for leaf plucking which takes place about four times a year. The prunings furnish the twig and bark material that is used. The leaves that are plucked are only the mature leaves and they are first dried, then ground up into a fine meal, and then given an elaborate series of washings in hot water, after which the gutta percha is separated out from the leaf fragments in cold water and purified by another hot water and mechanical treatment. The resulting purified product is rolled and pressed into blocks ready for treatment. The manufacturing plant is a large and expensive one, but the product is of excellent quality.

One of the factories in the Peninsula is believed to be built on very much the same lines as the one at Tjipetir.

It is probable that most of the future supplies of gutta percha will be prepared in such factories.

V.—INFERIOR GUTTAS AND SUBSTITUTES.

Several trees produce gutta percha which is relatively inferior because of the larger amount of resin contained. Several of the better known of these are briefly mentioned below:—

1. Getah Sundik.

Payena Leerii Kurz.

This is a medium-sized tree of rather wide distribution. It is found in the Malay Peninsula, Sumatra, Banca, Java, Amboina, Borneo, and the Philippine Islands, often near the sea coast. The following notes are taken from Heyne, "De Nuttige planten van Nederlandsch-Indie," Vol. IV., 1917, p. 11. "The getah is hard, becomes plastic in hot water and becomes hard again when cooled. The latex is thin and flows easily, so that it can be collected relatively free from impurities. It is naturally white, but changes colour and the product in trade is always more or less yellow. The getah is of fairly good quality, although it contains a large percentage of resin. It has the same resilience and also crackles when rubbed, like taban merah, with which it is sometimes mixed. It rarely appears on the market absolutely pure. It is sometimes mixed with dujan or puan (*Palaquium Treubii* Burck), hangkang (*P. leiocarpum* Burck), or djelu-

tong (*Dyera* spp.). Adulteration with hangkang or djelutong causes a change in colour and appearance, a decrease in resiliency, and a peculiar smell."

2. Getah Taban Puteh.

Palaquium obovatum King and Gamble.

This tree is known only from the Malay Peninsula. It is a larger tree than the others mentioned and is usually found on rather higher ground than the taban merah, although the two may be found together. The leaves are larger and blunter and the gutta is whiter, flows much more freely, and is less than half the value of that of taban merah.

3. Getah Hangkang.

Palaquium leiocarpum Boerl.

This is a large tree which is found only in Borneo, where it occurs on low lying ground. The gutta is whitish or slightly reddish, exported in large quantity, of rather low value, and used to adulterate the better kinds.

Getah Soh or Ang So.

This is a name given to the above species on the Singapore market. Frequently attempts are made to colour this material red in the effort to substitute it for getah taban merah, and species of bark are frequently included with it. One lot which was examined in Singapore was stained with the bark of Tengar (*Ceriops Candolleana* Arn.), fragments of which were included with the sample.

4. Semaram.

Payena Havilandi King and Gamble.

This is a species of common occurrence in the Malay Peninsula and said to furnish a gutta very similar to that of *Payena Leerii.*

5. Sangei.

This is a name applied to *Payena latifolia* Burck, *P. rubro-pedicellata* Burck, and possibly to other species of Borneo, Riouw, and parts of Sumatra, which are said to furnish a gutta similar to that of *Payena Leerii.*

6. Getah Ketapang.

Palaquium Clarkeanum King and Gamble.

This is a species of the Malay Peninsula, said to produce an inferior gutta used to adulterate guttas of better quality.

7. Taban Simpor.

Palaquium Maingayi King and Gamble.

A species of the Malay Peninsula, said to produce a fair grade of gutta that is usually adulterated by an admixture of Jelutong sap.

8. Taban Sutra or Taban Puteh.

Palaquium oxleyanum Pierre.

A species of the Malay Peninsula which is said to produce a very thick gutta, which is mixed by the collectors with the sap of jelutong or with that of some *Bassia* species.

9. Njatoh Dujan.

Palaquium Treubii Burck.

A Borneo species producing an inferior gutta, which is "bluish white with a dirty grey almost black surface. The section shows a compact hard mass which is not very elastic. Although it is fairly coherent, pieces can be broken off with a little force. The fracture shows a granular surface. By adding inferior kinds these qualities gradually change. Often used to adulterate better grades of gutta and it is also adulterated with inferior things, particularly jelutong."

10. Njatoh Renkeng.

Palaquium xanthochymum Pierre.

A yellowish second class gutta from the Malay Peninsula.

11. Mentua Taban, Taban Pertja, Getah Pertja.

Payena Maingayi Clarke.

This is a species of the Malay Peninsula which is sometimes credited with having furnished the name for gutta percha. The gutta is of poor quality and practically worthless.

It is probable that a number of other inferior guttas are used, but our knowledge of them is very incomplete.

Mention should be made of certain substances which are not true guttas, but which are sometimes mixed with gutta percha, to increase its bulk, or are substituted for it.

Balata. *Mimusops Balata.*

This South American tree, and possibly some of its nearly related species, furnishes the best known substitute for gutta percha. It is intermediate in properties between rubber and gutta percha, is obtained in fairly large quantities, and is used as a substitute for gutta percha for a number of special uses.

Wild Rubber.

Various forms of wild rubber, probably mainly the product of various species of *Willughbeia* and *Chilocarpus*, are sometimes used to adulterate gutta percha by native collectors.

Jelutong. *Dyera* spp.

The copious latex of this large tree is one of the most extensively used adulterants of gutta percha. Such adulteration is very often done by the collectors, to increase the bulk or appearance of the product, and it is even claimed that some Chinese dealers in Singapore use it.

VI.—TRADE IN GUTTA PERCHA AT SINGAPORE.

Getah taban merah, at the end of 1919, had a selling price per pikul of $760 (£1,192 per ton). Lower grades of gutta have been valued at correspondingly lower rates. Getah taban puteh (*Palaquium obovatum* C. B. Clarke) has sold for as much as $200 per pikul. Numerous other grades are not used because they contain too large a proportion of resin, or of impurities.

The export of gutta percha from Singapore during 1920 amounted to a value of $8,023,448. The average value of gutta percha exported from Singapore per year from 1913 to 1922, was $3,640,444.

The following table shows a summary of the trade in gutta percha and inferior guttas at Singapore from 1900 to 1920 inclusive:—

GUTTA PERCHA.	Imports.	Exports.
Total amount—pikuls	623,448	1,111,673
Total value	$65,946,432	$109,961,966
Average value per pikul	$105.78	$98.91
Nett gain in value in 21 years		$44,015,534

GUTTA INFERIOR.	Imports.	Exports.
Total amount—pikuls	3,861,484	3,597,151
Total value	$35,736,848	$35,004,321
Average value per pikul	$9.26	$9.73
Nett loss in value in 21 years		$732,527

The gutta percha referred to above should, in theory, be the pure gutta, but this is very far from being the case. It has been already mentioned that the collectors very generally adulterate the high grade gutta which they collect. This practise is very wide-spread and is done with varying degrees of skill. The crudest forms of adulteration, where twigs, bark, wood, or other foreign substances are used to increase the bulk, is the one most readily detected and the masses of raw material that are received in Singapore are examined by the buyer in various ways to dectect these frauds. It is usually necessary to heat the gutta at Singapore in order to clean it and put it into an attractive condition for export. The adulteration with inferior guttas and with Jelutong or other wild rubbers is less easily

detected. This gives an opportunity for various kinds of manipulation in the preparation of the gutta for export, and some of the Chinese in Singapore have become very adept in mixing high grade and low grade material so that the resulting product will have a higher price than that of the low grade product. The places and processes used in "purifying" the gutta are very jealously guarded, and strangers are not permitted to see the work done. Heyne has given the following note under getah taban merah:—"The getah appearing on the market is seldom unmixed getah of *Palaquium oblongifolium*, and if so, only in small quantities. Sometimes a single piece is found in mixtures of good quality. The trade, especially the Chinese trade, knows as getah merah mixtures of this one with inferior guttas, and the adulteration sometimes goes so far that the lots are only called getah merah because of the colour........In an absolutely pure condition the colour is reddish grey, sometimes copper coloured; the getah forms a very compact hard mass, of which it is not easy to tear a piece against the grain. A piece thrown on a stone or wooden floor rebounds, and when two pieces are rubbed together they make a crackling noise. A piece cut obliquely shows clearly the different layers of which it is composed. These characteristics are also found, but in a lesser degree, in getah merah; in the most inferior mixtures they have totally disappeared. Mixed with bits of wood, it often gets a red or dark brown, in *Payena Leerii* a grey colour, while additions of other guttas cause different shades from grey to brown.......Inferior qualities are often boiled again once or several times, through which a more thorough mixing takes place, and a product is obtained which looks really good, and

gives the impression of being of an even composition, but which is not very coherent or elastic. When mixed only with getah dujan, which is itself a good kind of getah, a good product is sometimes obtained which is fairly coherent, but which by its brittleness shows that it is mixed with dujan."

The largest quantity of gutta received is said to be hangkang (*Palaquium leiocarpum* Burck) which is exported to the amount of several thousands of tons per year from Borneo. It has a smell similar to that of Jelutong. "Among the gutta perchas hangkang occupies about the same place as Jelutong among the rubbers; its market value is higher, because hangkang does not contain an excessive amount of water like the jelutong which is offered for sale."

Jelutong seems also to be very largely used.

As will be seen from the table above, the quantity of gutta percha exported from Singapore is almost 80 per cent. greater than the amount imported and there is a certain decrease in the amount of gutta inferior during its stay in Singapore. The unit value of the gutta is decreased and the unit value of the gutta inferior is slightly increased by the treatment given to it in Singapore, but the nett result to the trade in Singapore amounts to a profit of more than $2,000,000 per year.

Practically the only unadulterated gutta percha known to be exported from Singapore is the leaf gutta from the different factories and the tapped gutta supplied by the Forest Department of the Federated Malay States.

MALAYAN SERIES No. XIX.

DAMAR AND COPAL.

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DAMAR AND COPAL.

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1923.

Damar and Copal.

DAMAR is the Malay name for resin or for a torch made of resin. Large numbers of plants produce resins which are of more or less importance commercially. A few of the more important or better known resins are dealt with here. Following the practice of the European markets, the terms copal and damar may be used to indicate our two most important groups of resins.

COPAL.

This term is not used in the Malay region. It is, however, used in the European markets to indicate those hard resins which have a relatively high melting point, are relatively resistant to various solvents, and furnish a varnish which dries with a hard surface. There is only one important member of this group in British Malaya.

Damar Minyak or Damar Sanum.

This is derived from the tree known by the same name in the Malay Peninsula, *Agathis alba* (Lamk.) Foxw., which is widely distributed throughout the Malayan region, usually on the higher hills. It is sometimes found, in the Malay Peninsula, at as low an elevation as one thousand feet above sea level. The tree grows to a very large size and the resin may be collected from fresh wounds in the bark, but is more often collected from old wounds where it has hardened and crystallized, or from deposits in the ground at the base of the tree. This last is called

fossil resin and is the most valuable. The resin is valued locally at from $12.00 to $16.00 per picul.* Large amounts are collected in Sumatra and other parts of the Netherlands Indies, Borneo, and the Philippine Islands. Much the largest part collected in the whole region passes through Singapore. The export for 1920 amounted to 70,125 pikuls (4,174.1 tons) with a value of $2,572,097 (£300,128). The average value declared for the exported material during the past 25 years has been about $15.00 per pikul, but it has at times been valued at considerably more than twice this amount. The resin is sent to Europe and America and is used in the manufacture of the finer grades of varnish, patent leather, and sealing wax. It is also suitable for the manufacture of cheap soaps and paper size. The collection of the resin is arduous work and it is very little done now in the Peninsula, although there are large exports from the Bornean countries. The resin is known in the Philippine Islands as Almaciga and in Europe as Manila Copal. The tree is very closely related to the Kauri Pine of New Zealand and the resin has, apparently, the same properties as that derived from Kauri. It is but little used locally, except in torches and native medicine. Sometimes small bits of the fresh semiliquid gum are applied to the feet to prevent the attacks of leeches. It would be possible to increase considerably the outturn of this resin by a systematic tapping of the trees, but careful organization and supervision would be needed. It is claimed that a large tree can be so tapped as to yield more than a pikul of the resin per year, but it has not been proved that this can be done without serious injury to the tree.

* 133⅓ lbs.

DAMAR OR DIPTEROCARP RESINS.

The name Damar has been restricted, in the European market, to the resins of the family Dipterocarpaceae, the group which contains the most important and abundant timber trees in Malayan forests. All the species contain resin in the bark and wood, though, in many species, the amount or quality of resin produced does not repay collection. There are quite a number of different kinds of Damar. Collectively, they differ from the resin of *Agathis alba* in that they are not completely soluble in chloral hydrate. They are also less hard, have a slightly lower melting point, and produce a softer surface in a varnish.

Damar Mata Kuching.

(Cat's Eye Damar).

This has usually, until very recently, been considered the best of the Damars. It may be that it really is the best, but it has been so incompletely known as to source that the quality is by no means always uniform. There is still doubt as to the botanical origin of a number of the plants producing this Damar. It is known that a number of different species produce it, but the species are very poorly understood. In the Malay Peninsula it is produced by the species *Hopea intermedia* King, *H. globosa* Brandis, *H. micrantha* Hook. f., and probably also by *H. mengarawan* Miq., and several other species of the same genus. Several of these species are known also by the name of Merawan. The Damar occurs as hard, clear, transparent drops or "tears" of resin on the bark or coming from injuries to the trunk of the tree. It can also be secured by

artificially wounding the tree, and experiments are being made by the Forest Department of the Federated Malay States to determine the effect upon the tree of systematic tapping for the resin.

Other forms produce a Damar of slightly lower grade, which occurs in yellowish, translucent, irregular stalactitic masses of larger size than the "tears" of Damar Mata Kuching. It is probable that dealers sometimes mix lower grades of resin with the Damar Mata Kuching which they ship. There remains a great deal of work to be done in the classification of these different, but closely related, Damars.

Damar Penak.

At present the most important and valuable Damar of the Malay Peninsula is Damar Penak, produced by *Balanocarpus Heimii* King. This, formerly, did not bring a high price, because it was not carefully collected and was mixed with other and inferior Damars. In 1922 the Forest Department of the Federated Malay States began the experimental working of this product, with very beneficial results. The Damar is now more carefully collected and graded, the collector receives more pay for his work, and Government has a considerably enhanced revenue. Methods of collecting and cleaning have been, to some extent, standardized, and a product of uniform standard and guaranteed authenticity can now be supplied. The collecting is done in the following manner. The trees being very large, they are not easy to climb, but it seems necessary to do some of the collecting from the higher parts of the trunk and on the branches in order to get the best quality of resin and also to get a large yield.

Climbers, or small trees in contact with the tree from which collecting is to be done, are used wherever possible. Where these are not available, the collector may use a pole or he may use his axe or chopping knife to make a foothold at intervals. Oftentimes he uses a length of rattan passed around the tree and around his body. In any event he manages to climb the tree. This is difficult and dangerous work and it is often difficult to find men who are willing to do it. With whatever method is used, the collector makes a number of incisions in the bark and wood of the tree and branches. From these incisions the fluid resin flows and collects, gradually thickening and hardening. After about three months the resin has solidified and hardened sufficiently to be ready for collecting, when the collector again climbs the tree, removing the hardened resin and freshening up the surface of the cuts so that more resin may flow. The collecting may be done repeatedly, at intervals of three or four months. It seems that the collecting may go on indefinitely without any serious damage to the tree, if the work is carefully done. It is important that the cuts shall not be too rough nor too deep. A rough cut means that a dirty and impure product will be obtained, and a deep cut means damage to the tree. The collected resin is taken to a central place and hand sorted by Malay women into commercial grades. In Singapore, the sorting is done by Chinese, and discoloured pieces are scraped or split and freed from impurities and discolourations. The grades recognized by the Forest Department are *pale*, which is made up of very clean and light-coloured pieces, brings a price of $70 to $90 per pikul, and makes up 23 per cent. of the total amount collected: *yellow*, which is like the last except that

it has a faintly yellow colour, has a value of $50 to $60 per pikul, and makes up 48 per cent. of the total: *amber*, which has a slightly darker tint, apparently due to being a little older, has a value of $35 to $45 per pikul and makes up about 15 per cent. of the total. The residue is made up of "dust." This makes up approximately 14 per cent. of the total and has a value of only $6 to $10 per pikul. So far as has been discovered the dust is chemically of the same quality as the larger pieces, but it is harder to get it free from impurities, such as fragments of bark, insect remains, etc. The dust is classified as coarse or fine, according to the size of the particles. Considerable improvements have been made in the cleaning of the damar by the use of washing devices, careful hand sorting, etc. Experiments made by the Agricultural Chemist F.M.S. & S.S. have shown that there is no appreciable difference chemically between the grade known as "pale" and that called "amber," nor for the matter of that between the "pale" and the dust. The darker grades do, however, produce slightly darker coloured solutions. The analyses referred to have given the following results:—

Samples pale to amber in colour.

Melting point 90° to 92°C.

Ash 0.015 to 0.33%.

Acid value 38.9 to 45.4.

Solubility.

Alcohol—partially soluble, opalescent solution.

Ether— " " " "

Petroleum ether—partially soluble, slight opalescent solution.

Turpentine—soluble, clear solution.

The industry of damar collecting in the Malay Peninsula is still in a very primitive state, although a large amount of improvement has been made during the past two years. It would seem that the industry is capable of great expansion and improvement. The greatest difficulty, at present, is to persuade men to take on the work of collecting, but it is hoped that this difficulty can be overcome and that the supply can be greatly increased. Thus far, the departmental working of Damar has operated only in a restricted part of the Pensula, but it is hoped to extend this working to most of the damar producing areas in time. The outturn of very carefully cleaned Damar Penak during the last half of 1922 was about 600 pikuls. The Forest Department, F.M.S., can now undertake to supply an amount of 70 tons of carefully cleaned Damar Penak per year, and it is hoped that the outturn may be considerably increased within the next few years.

Less Valuable Damars.

There are quite a number of the inferior damars which occur in considerable quantities. Some of them are collected and exported under their own names; others are believed to be collected and used to adulterate the more valuable ones; and others are used only locally, or have such low value that they are often not collected because the market price is not sufficient to make the collection profitable. Only a few of the better known are mentioned here.

Damar Hitam.

This name was formerly applied to the damar of *Balanocarpus penangianus* King, which also has the name Sungei. This form is not abundant and the name is now often applied to the product of a

large species of *Shorea*, which is of common occurrence in parts of Johore. The resin flows from the wood and bark as a rather clear, shiny, dark reddish-brown material and rapidly hardens, becoming almost black. Trees are tapped for this resin in Johore, but its use is not understood. It has a value of \$15 to \$17 per pikul and small amounts are exported.

Damar Siput.

This is a product which occurs thickly on the bark of *Shorea Ridleyana* King, and possibly on other species, as a result of insect attacks. It is yellow, opaque and very full of impurities, which are partly bark remains and partly insect remains. Used locally for torches and for starting fires, and a certain amount is exported. The price locally is \$12 to \$17 per pikul. The uses of this resin are not well understood.

Damar Kepong and Damar Seraya.

These are names applied to certain opaque resins from certain species of *Shorea*. Damar Kepong has a dull, yellow-green, grey or marbled appearance, and is used for caulking, and lighting purposes. Damar Seraya is reddish brown and opaque. They are used locally in small amount and are occasionally exported.

Damar Batu.

This name is applied to a lower grade of resin produced by various species of *Shorea*. It is rather friable and opaque and has a yellow or brownish colour. It is found in various amounts, but its low price makes it scarcely worth collecting for export. It is used for torches, in making pitch, for caulking boats, and for certain insulating substances, usually

in combination with Minyak Keruing, the wood oil derived from various species of *Dipterocarpus*. The local market price is from \$1 to \$4 or \$5 per pikul, and large amounts could be secured, if the price were sufficient to pay for collection. Damar Batu is the name given to all low grade damars such as Kepong, Seraya, Daging, Siput, Kelulut, etc., when marketed mixed together. They are usually fossil damars, uncleaned and unsorted and sold as collected.

Damar Daging or Flesh Resin.

This is a red, opaque resin which breaks with a shining fracture. It is occasionally found of a pure dark red colour and occasionally with whitish layers or streaks, giving very much the appearance of a piece of meat. It is very little used and its botanical origin is not understood. All the samples examined have been collected from the ground. It has been suggested that it is old resin from *Shorea leprosula* Miq., but this has not been proved.

Damar Kelulut.

This is a product of insect work. It is found in the nests of certain insects, often inside of hollow trees. These insects are often small bees which are said to eat the resin from certain trees of the Dipterocarpaceae and to combine it with some product from their bodies to make their nests. This resin is often quite impure. It is sometimes found in large masses and is used for torches, and, mixed with oil, for caulking boats.

"Fossil" or Buried Resin.

This is a form of Damar Batu which is frequently found along rivers or where the soil is turned over. Considerable quantities have been brought up

by the tin dredges at Taiping, and occasional large pieces are washed up on sand banks by the rivers. It is usually very impure material and is doubtless the remains of trees which have disappeared. It is of low value and is used for little besides torches and to start fires.

Damar Torches.

These are made by mixing decayed wood and bark chips with wood oil, or Minyak Keruing, and powdered low grade damars, wrapping this mixture in palm or ginger leaves in a cylindrical or slightly tapering package 1½ to 2 feet long, and binding with split rattan. They are used to illuminate small houses in the jungle or are carried by bullock cart drivers to light their carts at night. Formerly, many of the houses of the poorer people were lighted by damars and the upper part of the house was often very much discoloured by the dark smoke. Nowadays these torches have, in many cases, been superseded by kerosine lamps. Many of the jungle people carry these torches about with them so that they can use them in starting fires for their cooking. Many of the damars make excellent fire lighters, which are very useful in a wet climate.

TRADE IN DAMAR AND COPAL AT SINGAPORE.

The following are the figures for the trade in these substances at Singapore for the years 1900 to 1920 inclusive:—

COPAL.	Imports.	Exports.
Total amount—pikuls	1,994,408	2,403,867
Total value	$26,464,436	$36,073,141
Average value per pikul	$13.27	$15.01
Nett gain in value		$9,608,705

DAMAR.	Imports.	Exports.
Total amount—pikuls	1,623,142	1,439,932
Total value	$10,924,913	$11,703,224
Average value per pikul	$6.73	$8.13
Nett gain in value		$778,311

It will be seen that the gain in value shown for the Singapore traders averages about one half million dollars per year on the two products, or about 22 per cent. on the value of the business handled. Unfortunately, the different kinds of damar do not appear separately in the customs returns, so it is not possible to tell the proportions of the different kinds of damars handled.

The different damars receive a great deal of attention at Singapore and are very carefully sorted. A large number of grades are recognized. Pieces which are dull or contain impurities are scraped and the impurities picked out. The grading is usually done by Chinese women. It seems probable that there is a certain amount of mixing of low grade with high grade material to increase its bulk.